TEMS™ CellPlanner

GSM User's Guide

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Preface

Document Conventions

This document uses the following conventions:

Bold type	Window names, button names, and keyboard keys are displayed as bold text. Example: Click **Edit.**
Menu↗Selection	Navigation in menu paths are displayed as bold text with arrows between menu levels.
`Typewriter type`	File names and literal input and output. Example: `sites.xml`
Italic type	Book titles and definitions are displayed in italic. Examples: *carrier mapping, Technical Reference Manual*
Left-click Right-click	All instructions including mouse clicks assume a mouse configured with the left mouse button as primary button.

Navigation

Use the ALT ← and ALT → buttons to navigate between link jumps in the Manuals.

Assumed Knowledge

This documentation presumes that you have good knowledge about radio network planning principles and the radio technology to plan.

Disclaimer

The parameter values in this manual are just examples to help you getting started quickly, and do not constitute any performance guarantees for the planned equipment of your final network planning.

Proper parameter values depend on the equipment version, the operator's business plan, and the operator's network deployment strategy. Recommended parameter values should be provided by the operator, the equipment vendor or your service delivery organization.

Manuals

The following PDF manuals are delivered with the TEMS CellPlanner software:

Installation Guide

EN/LZT 108 9831 R4A

Describes system requirements, how to install and configure TEMS CellPlanner components and manage licenses, and provides an overview of all TEMS CellPlanner components. The procedures must be performed by a user with administrator privileges on the local computer. Some procedures require that you are an authorized TEMS CellPlanner administrator.

Common Features User's Guide

EN/LZT 108 9832 R4A

Includes Glossary of terms used in TEMS CellPlanner, concepts about licenses, and how use projects, explorer objects used by more than one radio technology, how to add sites and use site tools, filters, plots, neighbors, AMI, tuning propagation models, ASMT (Automatic Sector Model Tuning), puncturing, export and import data, and work with projects on server. Here TEMS CellPlanner administrators find how to administer users, groups and projects on servers shared by multiple users.

Common Features Technical Reference Manual

EN/LZT 108 9833 R4A

Describes radio technology independent algorithms, parameters and file formats.

GeoData User's Guide

EN/LZT 108 9834 R4A

Describes geodata concepts, supported geodata formats, conversion between different map formats, how to use map data tools in TEMS CellPlanner. The chapters about providing and importing map data are intended for administrators of map data. Other chapters are intended for users of map data.

Map Import Wizard User's Guide

EN/LZT 108 9943 R2A

Describes how to import map data using a generic wizard similar to the one provided with TEMS LinkPlanner. The intended reader is administrator of map data.

LTE User's Guide

EN/LZT 108 9944 R3A

Describes how to use LTE functions of TEMS CellPlanner, including analysis, and creation of plots and reports.

LTE Technical Reference Manual

EN/LZT 138 0235 R2A

Describes LTE network planning principles, analysis details for advanced users, and cell ID planning principles.

WCDMA User's Guide

EN/LZT 108 9837 R4A

How to use WCDMA functions of TEMS CellPlanner, including analysis, and creation of plots and reports.

WCDMA Technical Reference Manual

EN/LZT 108 9838 R4A

Describes concepts and overviews of WCDMA algorithms, and HSPA and MBMS in TEMS CellPlanner.

GSM User's Guide

EN/LZT 108 9835 R4A

Describes how to use the GSM functions of TEMS CellPlanner, including analysis, and creation of plots and reports.

GSM Technical Reference Manual

EN/LZT 108 9836 R4A

Describes overlaid/underlaid cell structures, reuse patterns, manual frequency planning, automatic frequency planning (AFP), automatic hopping frequency set (HFS) planning, optimization of BSIC, HSN and MAIO, fractional load planning, and effective subscriber modeling. Also describes the GSM algorithms and file formats used in TEMS CellPlanner.

WiMAX User's Guide

EN/LZT 108 9839 R4A

Describes how to use the WiMAX functions of TEMS CellPlanner, including analysis, and creation of plots and reports.

1
Overview of TEMS CellPlanner

This chapter provides an overview of the TEMS CellPlanner product.

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About TEMS CellPlanner

TEMS™ CellPlanner is a graphical PC-based application for designing, implementing, and optimizing mobile radio networks. It assists you in performing complex tasks, including network dimensioning, traffic planning, site configuration, frequency planning, and network optimization.

Installation

The Installation Guide describes how to install software and licenses.

Product Packaging

The product package includes the software components listed below.

What is actually installed depends on your selection in the installation wizard.

Product Components	Selecting this component installs...
• TEMS CellPlanner *named "TEMS CellPlanner Client" in the manuals*	• Radio Technology Features • Planning Features • Manuals • Map tools, geodata conversion software, demo maps, filters, scripts • Citrix software - relevant only if you are going to offer this TEMS CellPlanner installation as a Citrix service
• Enterprise Server	Enterprise Server software plus the User Administration software
• Zero Admin Server	Zero Admin Server software plus the User Administration software
• User Administration	User Administration software only
• License Server	License Server software only

Some of the components are licensed, see Licensed Components on page 1-3.

The Installation Guide provides an overview of each component and how the components relate to each other.

Licenses

The Installation Guide describes how to install licenses.
The Common Features User's Guide describes how to activate licensed features.

Licensed Components

Three of the Product Components are licensed:

TEMS CellPlanner *named "TEMS CellPlanner Client" in the manuals*	To start TEMS CellPlanner you need a license for at least one of the Radio Technology Features. Additional licenses are required for each of the Radio Technology Features and Planning Features to use.
Enterprise Server	License required to start the server
Zero Admin Server	License required to start the server

Radio Technology Features

Each of the radio technology software modules listed below require an installed and activated license. How to use the radio technology software is described in adherent user guides and technical reference manuals.

- GSM
- WCDMA
- WCDMA,HSPA
- WiMAX
- LTE

Planning Features

Additional planning features can be used together with the radio technology software. These additional software modules require a license for the feature itself and a license for the adherent radio technology:

• Automatic Cell Planning	Requires WCDMA or WCDMA,HSPA license
• Automatic Frequency Planning	Requires GSM license. This license is required also for automatic HFS planning.
• Automatic Measurement Integration and ASMT	Requires license for at least one of the Radio Technology Features ASMT = Automatic Sector Model Tuning.

Support and FAQ

For support and FAQ about TEMS CellPlanner, use the TEMS support web site:

www.ascom.com/networktesting

To provide TEMS support with information when reporting a problem, follow the instructions in chapter *Support Information* in the Installation Guide.

2
GSM in TEMS CellPlanner

This chapter provides an overview of the GSM capabilities and analysis functions of TEMS CellPlanner.

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About GSM in TEMS CellPlanner

The GSM module in TEMS CellPlanner provides analysis functions to create plots and reports for GSM cell planning, optimizations to facilitate your network planning, and export/import functions to exchange GSM data with OSS-RC.

GSM License

To get access to the GSM module in TEMS CellPlanner you need to acquire and activate a GSM license. You also need a license to use Automatic Frequency Planning (AFP).

For information on how to install a license, see *Installing TEMS CellPlanner* in the *TEMS CellPlanner Installation Guide*.

For information on how to activate licenses, see *Licenses* in the *TEMS CellPlanner Common Features User's Guide*.

GSM Standards

TEMS CellPlanner provides analysis of network and terminal equipment compliant with the a large number of GSM standards, in particular from the 3GPP series 43 and 45.

The planning methodology is partly described in *3GPP TR 43.030 Radio network planning aspects*, a Technical Specification of Group GSM/EDGE Radio Access Network.

TEMS CellPlanner also supports some Ericsson specific solutions of non-standard concepts, such as Hierarchical Cell Structures (HCS).

GSM Frequency Bands

TEMS CellPlanner provides predefined settings for the following GSM bands:

- GSM 850
- GSM 900
- E-GSM 900
- R-GSM 900
- GSM 1800
- GSM 1900

GSM Capabilities

TEMS CellPlanner supports the following GSM capabilities:

- GPRS
- EDGE/EGPRS/EDGE Evolution
- Hierarchical Cell Structures (HCS) with overlaid/underlaid cell pairs, single-band and dual-band
- 1-2 rx antennas in terminals

GSM Analysis Functions

TEMS CellPlanner produces the following GSM analysis results:

- Best server coverage plots
- Coverage report showing covered area or individuals
- Traffic performance plots and report
- Interference plots and report

GSM Automation and Optimization Features

TEMS CellPlanner provides the following automation and optimization features:

- Automatic Frequency Planning (AFP)
- Automatically generated neighbor lists
- Optimized BSIC
- Optimized HSN
- Optimized MAIO
- Optimized HFS

GSM Import and Export Data

TEMS CellPlanner supports import and export of the following GSM data

- Neighbor lists GSM-GSM as well as GSM/WCDMA/GSM and GSM/LTE/GSM
- Interference data
- Network data for GSM OSS-RC, in CNAI format
- CellOpt AFP data for CellOpt version 3.0

GSM Network Planning with TEMS CellPlanner

The below activities are examples of how to plan a GSM network with TEMS CellPlanner. The information in this chapter is not complete, but gives you a hint on the information required to plan the network, the main activities and some results to obtain.

Prerequisites

You need the following information to create a GSM network plan in TEMS CellPlanner:

- Map data as input to analysis functions, see *TEMS CellPlanner GeoData User's Guide*
- RF measurements as input to optimized propagation models, see chapter *Tuning Propagation Models* in the *TEMS CellPlanner Common Features User's Guide*.
- Site data such as coordinates, location areas, registration areas, neighbor relations and antenna configuration.
- Traffic load estimates for GSM services to support in the network.

If WCDMA-GSM handover is required, WCDMA site data and neighbor relations shall be provided as well.

Process

The activities below roughly describe how to work with TEMS CellPlanner to build your GSM network plan.

- Plan the sites as described in GSM Sites, RBSs and Cells on page 9-1.
- Predict the coverage, interference and traffic performance, see GSM Analysis on page 15-1
- When site positions are fixed, perform frequency planning, see Frequency Planning in TEMS CellPlanner on page 18-2.
- When the network is implemented, ensure that the network plan is consistent with the actual implementation.
- Verify with field measurements that the implemented network meets the requirements.
- If needed, enter measurement data to TEMS CellPlanner to refine propagation models and analysis.

Results

During the planning, use the plots and reports provided by TEMS CellPlanner, see GSM Plots on page 16-1, GSM Reports on page 17-1 and Import and Export of GSM Data on page 13-1.

Some information can both be imported into and exported from TEMS CellPlanner:

- Cells text file, including cell name, RBS name, antenna information, frequency band, site position, ASC, TMA and feeder cable information
- GSM carriers text file, with information about channel groups and TRXs
- Neighbor lists

3
Getting Started With TEMS CellPlanner

The first time you use TEMS CellPlanner, read the chapter *Using TEMS CellPlanner* in the *TEMS CellPlanner Common Features User's Guide*

Here you find information on

- how to start and exit TEMS CellPlanner
- how to use the windows, menus and explorers

.

4
GSM Project

This chapter describes how to initiate and save a project, and how to configure the GSM specific project parameters. After having setup your project using the procedures in this chapter, proceed with the subsequent chapters to build your GSM network plan.

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Define Project Specific Information 4-2
Define User Specific Information. 4-3
Check, Save and Close a Project 4-3
GSM Project Parameters 4-4
Configure GSM Project Parameters. 4-4

About GSM Projects

A GSM network plan is developed within a project, stored as a file for single-user access, or in a database on a TEMS CellPlanner server to be shared with other planners.

Your changes to the network plan are stored persistently first when you explicitly **save** the project. The **apply** operations in the tool does not save the project persistently.

Working with a GSM Project

The order of procedures in this chapter follows a standard order for working with a project in TEMS CellPlanner.

Procedures in *italic* font are described in the *TEMS CellPlanner Common Features User's Guide*.

Create or Open a Project

Start your work with the network plan by creating a new TEMS CellPlanner project, or open an existing TEMS CellPlanner project to modify an initiated project.

To create a new project, see *Define General Project Settings* or, to open an existing project, see *Open Existing Project.*

Note: *If the project is or shall be stored on a server, see instead chapter Working with Projects on Server.*

Define Project Specific Information

The project specific information is configured from **File↗Project settings**. If you share the project with other planners, these settings apply for all users of the project.

Prerequisites

A project is opened.

Procedures

Use the following procedures to define project specific information:

1. *Define General Project Settings*
2. *Select Coordinate System for Project*
3. *Add Map Layers to Projects*

Note: *You must add map layers in two places: The map layers in the Project settings can be included in propagation models, required for the pathloss calculations. The map layers in the Map properties are used for display only.*

4. *Define Object Names*
5. Configure technology dependent information, see Configure GSM Project Parameters on page 4-4.

Define User Specific Information

The user specific information is configured from **File↗User settings**. If you share the project with other planners, the user settings apply only to a single user and override default project settings.

See *Define User Settings* in the *TEMS CellPlanner Common Features User's Guide*.

Check, Save and Close a Project

Your changes to a project must be saved to be kept persistently. Before saving it is recommended to check the consistency of the project.

Prerequisites

A project is opened.

Procedures

Use the following procedures to check, save and close a project:

1. *Check Project Consistency*
2. *Save Project*

   Note: *If the project is or shall be stored in on a server, see instead chapter Working with Projects on Server.*

3. *Close Project*

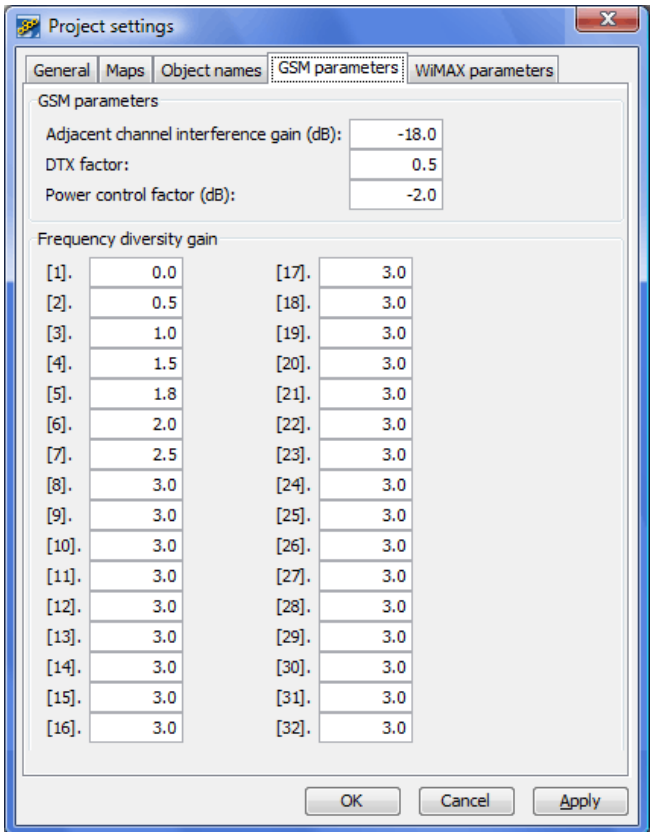
GSM Project Parameters

All users of a GSM project must use some global GSM parameters, configured as project parameters.

Configure GSM Project Parameters

Do as follows to define global GSM parameters for a project:

1. Select **File↗Project settings**, tab **GSM parameters**.



2. Adjust GSM parameter settings as required, and click **OK**.

Fields on the "Project settings" Window

Adjacent channel interference gain (dB)	Interference gain in dB for adjacent channels.
DTX factor (dB)	Discontinuous transmission (DTX) factor in dB.
Power control factor (dB)	Power control factor in dB.
Frequency diversity gain	Diversity gain for up to 32 frequencies.

5
Working with TEMS CellPlanner Server

You can share your GSM network plan with other planners by storing it on a TEMS CellPlanner server.

Read more about sharing network plans in *Working with Projects on Server* and *Administering Database Users and Projects* in the *TEMS CellPlanner Common Features User's Guide*.

6
GSM System Data and Services

This chapter describes how to define the system data and services of a GSM network plan.

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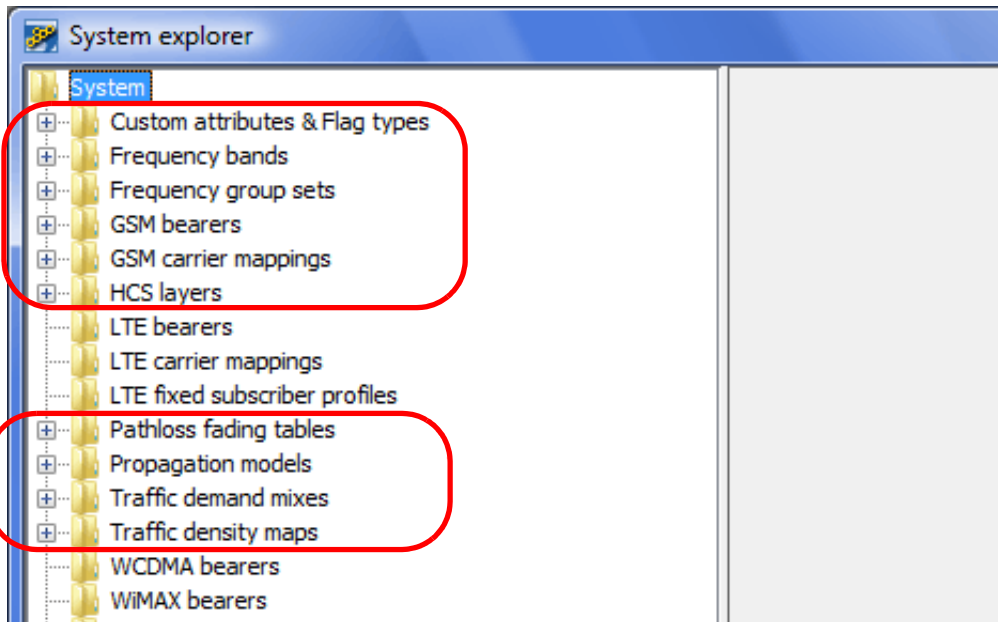
About GSM System Data and Services

Before adding sites, RBSs and cells you need to define the system data and services to be used in your GSM network. S*ystem data* may be common for GSM and other technologies. *Services* are technology dependent, that is, only the GSM services can be defined in a GSM network plan.

You can add or delete system data and services using the right-click mouse menus in the **System explorer**. In the figure below, the system data and services relevant for GSM are highlighted:



The standard flow of planning system data and services in a GSM network with TEMS CellPlanner is reflected in the order of procedures in this chapter. The list below shows this standard flow, in a recommended order:

1. **GSM carrier mappings** - TRXs associated with carriers
2. **Frequency bands** - GSM frequency bands with carrier selection
3. **Frequency group sets** (optional) - groups of carriers, with GSM example
4. **GSM bearers** - bearers for GSM services such as voice, GPRS and EDGE
5. Propagation models - land use category dependent radio wave behavior
6. Traffic density maps - land use category dependent traffic density
7. Traffic demand - geographical distribution of traffic, with GSM example
8. Custom attributes and flag types - attributes of GSM RBS or cell

The **bold** GSM services and system data are described in this *TEMS CellPlanner GSM User's Guide*. The other system data are described in the *TEMS CellPlanner Common Features User's Guide*.

GSM Carrier Mappings

The relation between the number of TRXs and the number of TCH time slots is important for the traffic analysis. In addition, the number of time slots reserved for packet data are important for the GPRS, EGPRS and EDGE Evolution part of the traffic analysis. You configure this relation between TRX and time slots as *GSM carrier mappings* using the procedure below.

At a later stage of the planning, the GSM carrier mapping is included in the GSM cell configuration, see Select GSM Cell Carrier Mappings on page 9-19.

Define GSM Carrier Mappings

Use this procedure to map TRXs to carriers.

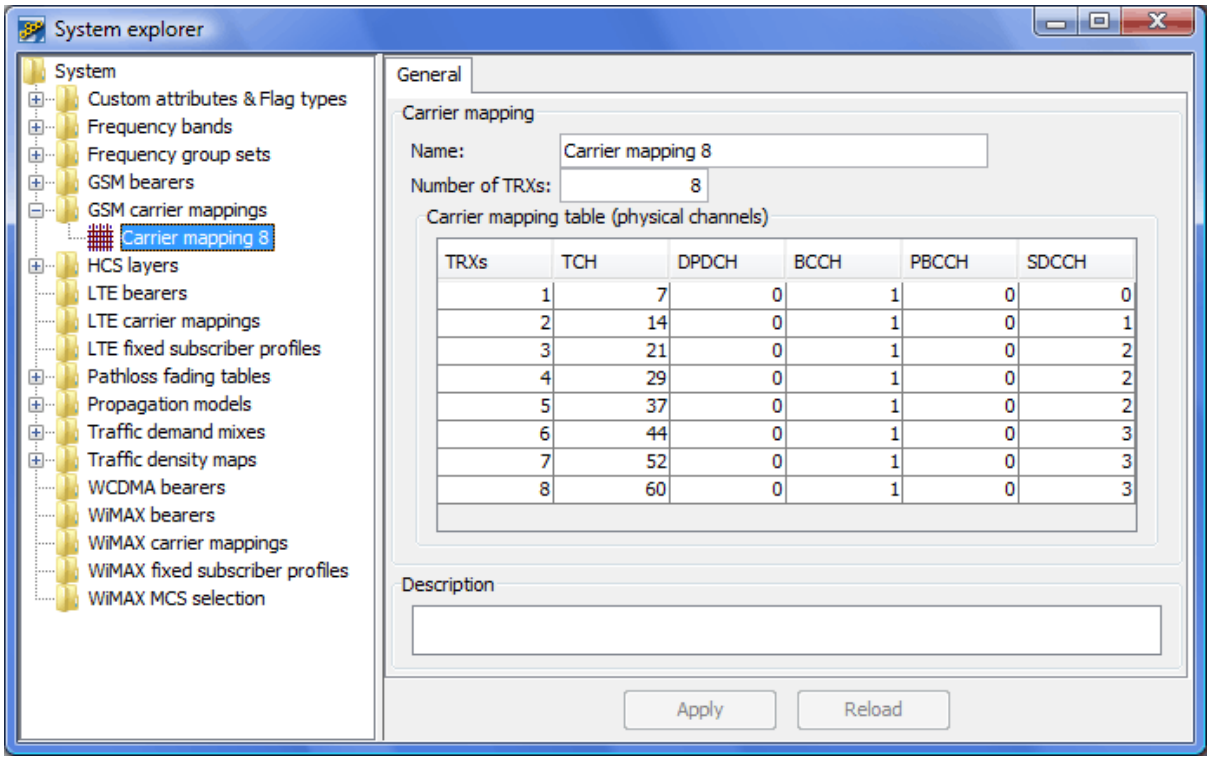
Prerequisites

A GSM project is opened.

Procedure

1. Select **Utilities↗System explorer**.
2. To create a new carrier mapping, right-click the **GSM carrier mapping** folder and select **Add carrier mapping**. To modify an existing carrier mapping, select the carrier mapping in the **GSM carrier mapping** folder.
3. The **GSM carrier mapping** window is displayed.
4. Set the number of TRXs to the maximum used by any cell in your network.
5. Edit the number of SDCCH so that they equal the SDCCH channels used in your network for each number of TRXs.
6. If the carrier mapping shall be used by overlaid sub-cells, set BCCH to 0, as overlaid sub-cells do not need any BCCH.

7. Click **Apply** to preserve the carrier mapping settings. The result might look as in the following example:



Fields on Window "Carrier mapping"

Name	Name of the carrier mapping. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Number of TRXs	Maximum number of transceivers used by the carrier mapping
Carrier mapping table	Indicates the channels to use with each number of TRXs: • TRXs - Transceivers • TCH - Traffic Channel • DPDCH - Dedicated Packet Data Channel (for GPRS) • BCCH - Broadcast Control Channel • PBCCH - Packet BCCH (may be used for GPRS) • SDCCH - Standalone Dedicated Control Channel
Description	Description of the carrier mapping

GSM Frequency Bands

About GSM Frequency Bands

A GSM frequency band consists of the BCCH and TCH layers. Each cell must have exactly one BCCH frequency. The frequencies allocated for BCCH and TCH may overlap.

3GPP TS 45.005, corresponding to the ETSI standard EN 300 910 and the GSM standard 05.05, specifies 14 frequency bands.

TEMS CellPlanner provides predefined configurations for a subset of those frequency bands. The predefined frequency bands are as follows:

- GSM 850
- GSM 900
- E-GSM 900, extension of GSM 900
- R-GSM 900, extension of GSM 900
- GSM 1800
- GSM 1900

Predefined GSM Frequency Bands

The following table shows the predefined GSM frequency bands:

System	Downlink Frequency (MHz)	Downlink ARFCN(n)	Duplex Distance (MHz)
GSM 900	935 + 0.2*n	1 ≤ n ≤ 124	45
E-GSM 900	935 + 0.2*n 935 + 0.2*(n-1024)	1 ≤ n ≤ 124 975 ≤ n ≤ 1 023	45
R-GSM 900	935 + 0.2*n 935 + 0.2*(n-1024)	1 ≤ n ≤ 124 955 ≤ n ≤ 1 023	45
GSM-850	869.2 + 0.2*(n-128)	128 ≤ n ≤ 251	45
GSM-1800	1805.2 + 0.2*(n-512)	512 ≤ n ≤ 885	95
GSM-1900	1930.2 + 0.2*(n-512)	512 ≤ n ≤ 810	80

In a GSM network, the ARFCN is valid for uplink and downlink. The uplink frequency equals the downlink frequency minus the duplex distance.

Define GSM Frequency Bands

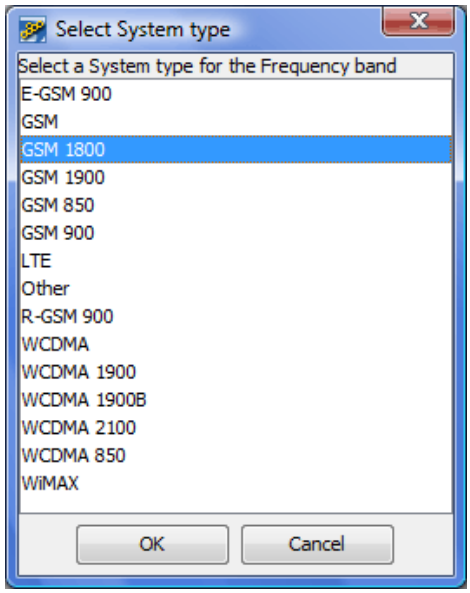
Use this procedure to add a frequency band to your GSM project and select carriers for BCCH and TCH.

Prerequisites

A GSM project is opened.

Procedure

1. Select **Utilities↗System explorer.**
2. Right-click the **Frequency Band** folder and select **Add Frequency band**. The **Select System type** window is deployed. This window shows the predefined system types, that is, combinations of Radio Access Technology and frequency band. In this example, GSM 1800 is selected:

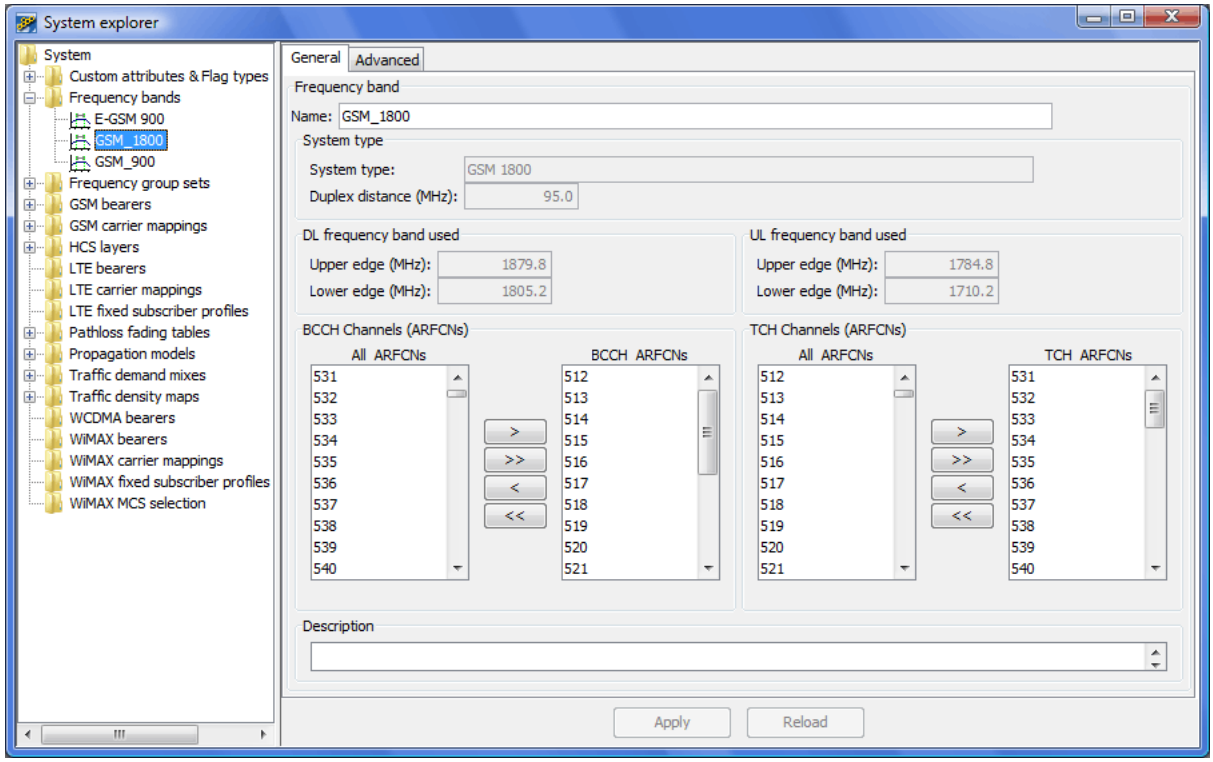


3. Select the GSM system type with the desired frequency band and click OK.The **Frequency band - General** tab is displayed. A base sub-band and optional sub-bands, viewable under the Advanced tab, are created. See Predefined GSM Frequency Bands on page 6-5 for information about frequency ranges.
4. Select carriers in the **Frequency band - General** tab:
   In the **BCCH carriers - All carriers** list, select the carriers to use as control (BCCH) carriers and move them to the **BCCH carriers** list. Click **>>** to select all carriers, or **>** to select specific carriers. Click **<<** to deselect all carriers, or **<** to deselect specific carriers.

   Note: *BCCH carriers shall not be selected for a frequency band to be used by overlaid sub-cells.*

5. In the **TCH carriers - All carriers** list, select the carriers to use as traffic (TCH) carriers and move them to the **TCH carriers** list. Click **>>** to select all carriers, or **>** to select specific carriers. Click **<<** to deselect all carriers, or **<** to deselect specific carriers.

6. Click **Apply**. The result might look as in the example below:



Fields on Window "Frequency band - General"

Name	Name of the frequency band. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
System type	The type of system for the frequency band.
Duplex distance (MHz)	The distance in MHz between uplink and downlink frequencies.
Upper edge (MHz)	The upper edge in MHz of the downlink frequency band.
Lower edge (MHz)	The lower edge in MHz of the downlink frequency band.
Upper edge (MHz)	The upper edge in MHz of the uplink frequency band.
Lower edge (MHz)	The lower edge in MHz of the uplink frequency band.
BCCH carriers	
All carriers	All carriers available as BCCH carriers for the frequency band, not yet chosen as BCCH carriers.
BCCH carriers	Carriers selected as BCCH carriers for the frequency band.
TCH carriers	
All carriers	All carriers available as TCH carriers for the frequency band, not yet chosen as TCH carriers.
TCH carriers	Carriers selected as TCH carriers for the frequency band.
Description	Description of the frequency band.

Define GSM Frequency Band Sub-bands

Use this procedure to extend an existing GSM 900 frequency band to R-GSM 900 or E-GSM 900, to re-create removed base sub-bands or sub-bands, or to just view existing base sub-band and optional sub-bands of a frequency band.

The base sub-band is normally enough. When you define a GSM frequency band for R-GSM 900, E-GSM 900 or any other system type requiring additional sub-bands, these sub-bands are automatically added.

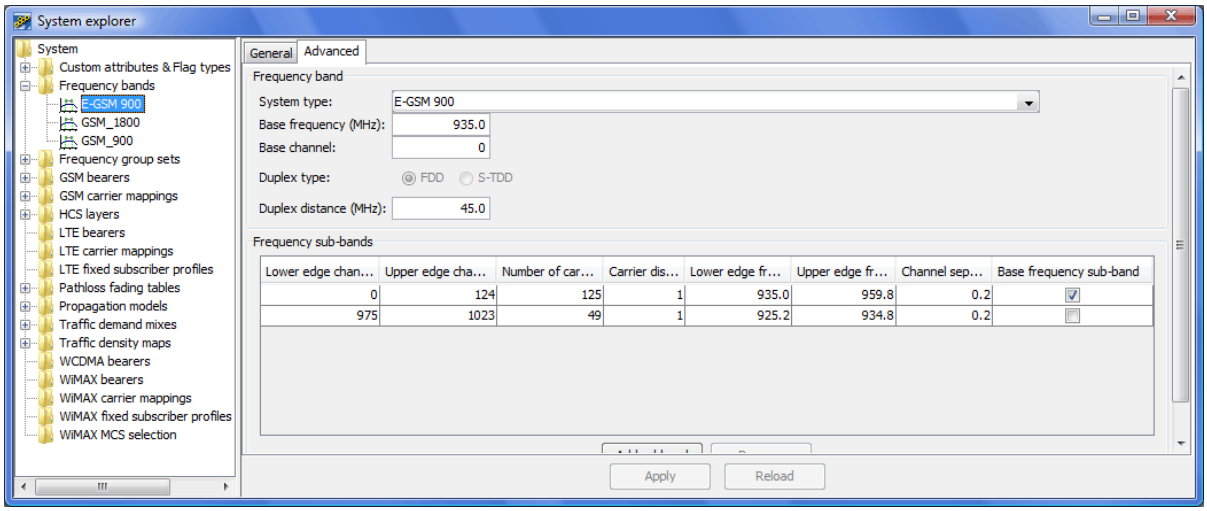
See Predefined GSM Frequency Bands on page 6-5 about the R-GSM 900 and E-GSM 900 sub-bands.

Prerequisites

A GSM frequency band has been defined, see Define GSM Frequency Bands on page 6-5.

Procedure

1. Select **Utilities↗System explorer.**
2. Select the frequency band to view or for which to add or modify sub-bands.
3. Select the **Advanced** tab to view the base sub-band and defined sub-bands.
4. For each sub-band to add, click **Add sub-band.** Each new sub-band appears in the *All carriers list* of BCCH and TCH under the **Frequency band - General** tab.
5. For each sub-band to modify, select the sub-band and modify its parameters.
6. For each sub-band to remove, select the sub-band and click **Remove**.
7. Click **Apply**. In this E-GSM 900 example, one sub-band is automatically added.



Fields on Window “Frequency band - Advanced”

Frequency band	
System type	Indicates the technology for the frequency band.
Base frequency (MHz)	The base frequency for the frequency band, derived from the lower edge frequency of the base sub-band (option **Base frequency** selected). Depending on system type, the base frequency is either identical to the lower edge frequency of the base sub-band, or to the lower edge frequency of carrier 0 (even if the base sub-band starts with carrier 1).
Base carrier	The carrier number associated with the Base frequency, that is, the lower edge carrier of the base sub-band (option **Base frequency** selected). Depending on system type, the base carrier is either identical to the lower edge carrier of the base sub-band, or to carrier 0 (even if the base sub-band starts with carrier 1).
Duplex type	Not used for GSM
Duplex distance (MHz)	The distance in MHz between uplink and downlink frequencies.
Carrier mapping	Not used for GSM
Carrier bandwidth (MHz)	Not used for GSM
Frequency band sub-bands	
Lower edge carrier	The carrier delimiting the lower edge of the frequency band.
Upper edge carrier	The carrier delimiting the upper edge of the frequency band.
Number carriers	The number of carriers for the subband.
Carrier dist	The distance interval between carriers.
Lower edge frequency (MHz)	The lower edge frequency in MHz of the subband.
Upper edge frequency (MHz)	The upper edge frequency in MHz of the subband.
Carr separation MHz)	Separation interval in MHz between each carrier.
Base frequency subband	Enabled if this is the base band, not a sub-band, of the frequency band.
Add subband	Adds a subband to the frequency band.
Remove	Removes a selected subband from the frequency band.

Frequency Group Sets

Sets of frequency groups are required input for Manually Optimized Frequency Planning only.

Define Frequency Group Sets

Use this procedure to define frequency group sets for manual frequency planning. Frequency group sets are selected when you Define Channel Group for GSM Cells, and later used in Manually Optimized Frequency Planning.

Prerequisites

The frequency band is defined, see Define GSM Frequency Bands on page 6-5.

Procedure

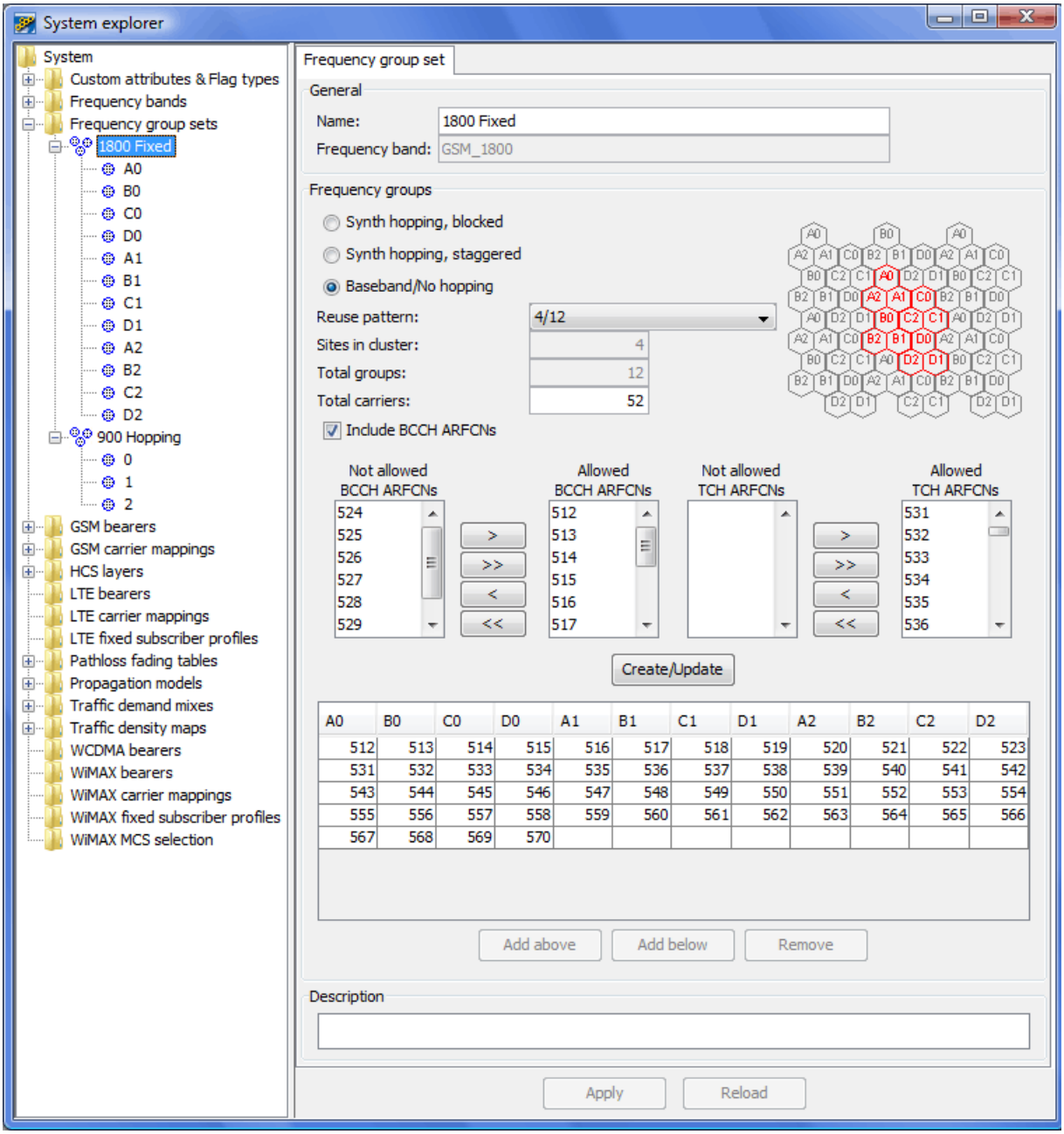
Follow these steps to define frequency group sets:

1. Select **Utilities↗System explorer.**
2. Right-click the **Frequency group set** folder and select **Add Frequency group set**. The **Select a frequency band** window lists the available frequency bands.
3. Select a GSM frequency band. The **Frequency group set** window is displayed.
4. Select a reuse pattern. The selected pattern is displayed graphically to the right.
5. Select carriers for the frequency group set.
6. Enter other frequency group settings as required, see Fields on Window "Frequency Group Set" on page 6-13.

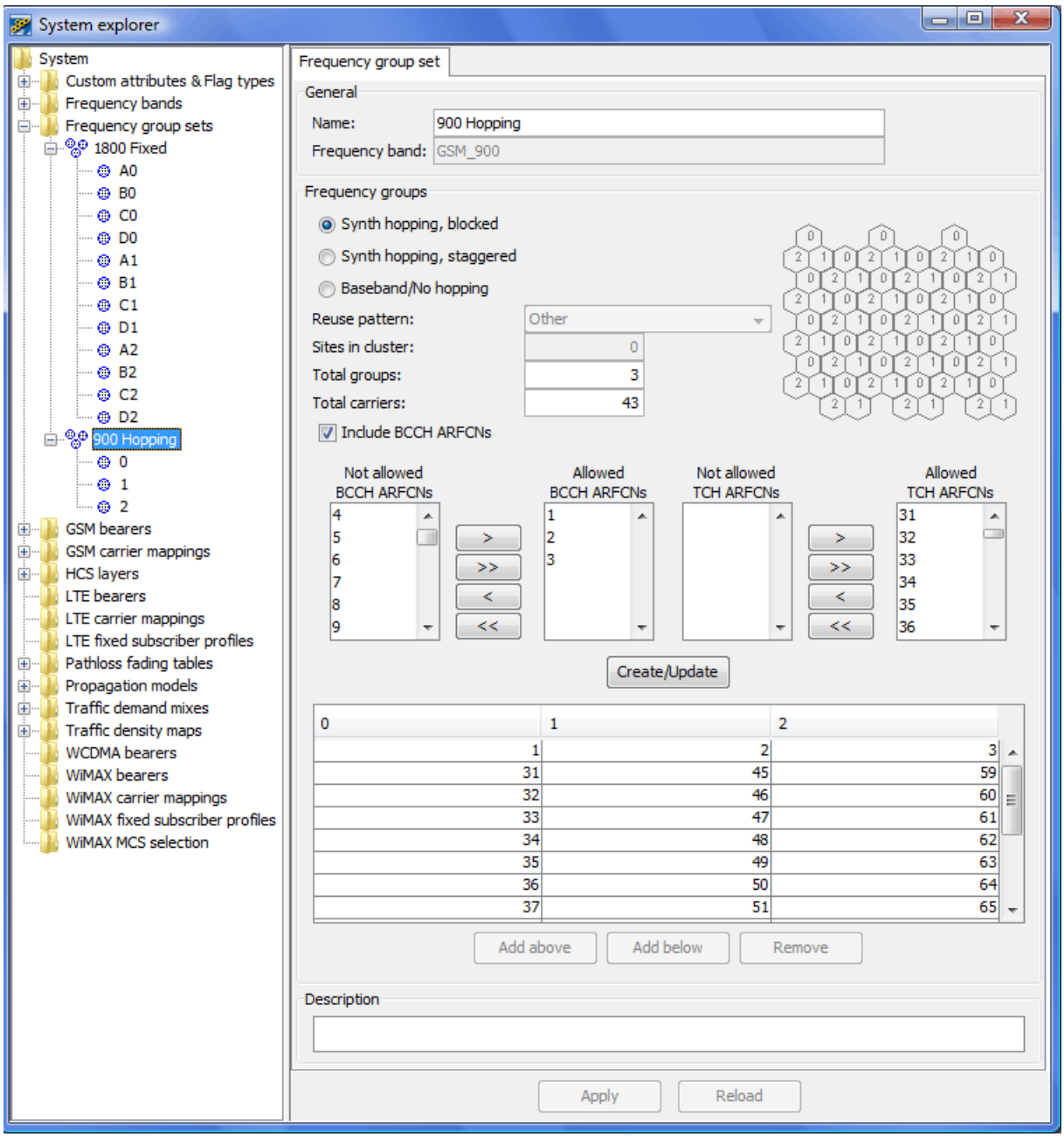
   Note: *You must select **Baseband/No hopping** if the frequency group set shall be used for Manually Optimized Frequency Planning. You may though select **Synth hopping** for pure manual planning of channel groups.*

7. Click **Apply**. The result might look as in the following examples:
   - Example: Frequency Group Set, No Hopping
   - Example: Frequency Group Set, Synth Hopping, Blocked

Example: Frequency Group Set, No Hopping



Example: Frequency Group Set, Synth Hopping, Blocked



Fields on Window “Frequency Group Set”

Name	Descriptive name of the frequency group set. You may want to include the reuse pattern and the frequency band in the name. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Frequency band	Frequency band used for the frequency group set.
Synth hopping, blocked **Synth hopping, staggered**	The frequencies in this frequency group set are synthesizer hopping, and frequencies are assigned to TRXs either in blocked or staggered order. One of these options must be selected if the frequency group set shall be used for AFP for Synth Hopping.
Baseband/No hopping	Baseband hopping or no hopping is used for the frequency group set. This option must be selected if the frequency group set shall be used for Manually Optimized Frequency Planning and AFP for Fixed Frequency or Baseband Hopping.
Reuse pattern	The reuse pattern for this frequency group set, selected from a list of predefined patterns: 1/3, 2/6, 3/9, 4/12, 5/15, 6/18, 7/21, or Other. The first number is the number of frequency groups in the set. The second number is the reuse factor. Example: A frequency group set with reuse factor 4/12 has 4 frequency groups with reuse factor 12. The selected pattern is marked in red in the graphic hexagon representation.
Sites in cluster	Number of sites in each cluster. This number corresponds to the first number of the reuse pattern.
Total Groups	Total number of frequency groups in the set. This number corresponds to the second number of the reuse pattern.
Total carriers	Total carriers to use for set.
Include BCCH carriers	Include BCCH carriers in the frequency group set. You must select this option if you want to use any BCCH carriers in the set.
Not allowed BCCH carriers	List of BCCH carriers not allowed in the frequency group set.
Allowed BCCH Carriers	List of BCCH carriers allowed in the frequency group set.
Not allowed TCH carriers	List of TCH carriers not allowed in the frequency group set.
Allowed TCH carriers	List of TCH carriers allowed in the frequency group set.
Create/Update	Create or update the frequency group set.
(Frequency group list, table at bottom of the window	List of frequency groups in the set. *Frequency groups* are named A0, A1, A2, B0, B1 and so on.
Add above	Adds selected carriers above the current line.
Add below	Adds selected carriers below the current line.
Remove	Removes selected carriers from the frequency group set.
Description	Description of the frequency group set.

GSM Bearers

A *GSM bearer* is a combination of a GSM service type (voice, GPRS or EGPRS) and one or more frequency bands (for example GSM 900 and GSM 1800). Two frequency bands are used to model dual-band terminals.

At a later stage of the planning, the GSM bearers are selected as part of:

- terminal definitions, see GSM Terminal Types on page 7-8.
- traffic cases in best server calculations and other analysis functions. See About Traffic Cases on page 15-3 for more information about GSM bearers in traffic cases.

Define GSM Bearers

The following bearers are suggested for a GSM network plan:

- Voice dual-band (GSM 900 and GSM 1800)
- Voice GSM 900
- GPRS
- EGPRS, if applicable
- EDGE Evolution, if applicable

Prerequisites

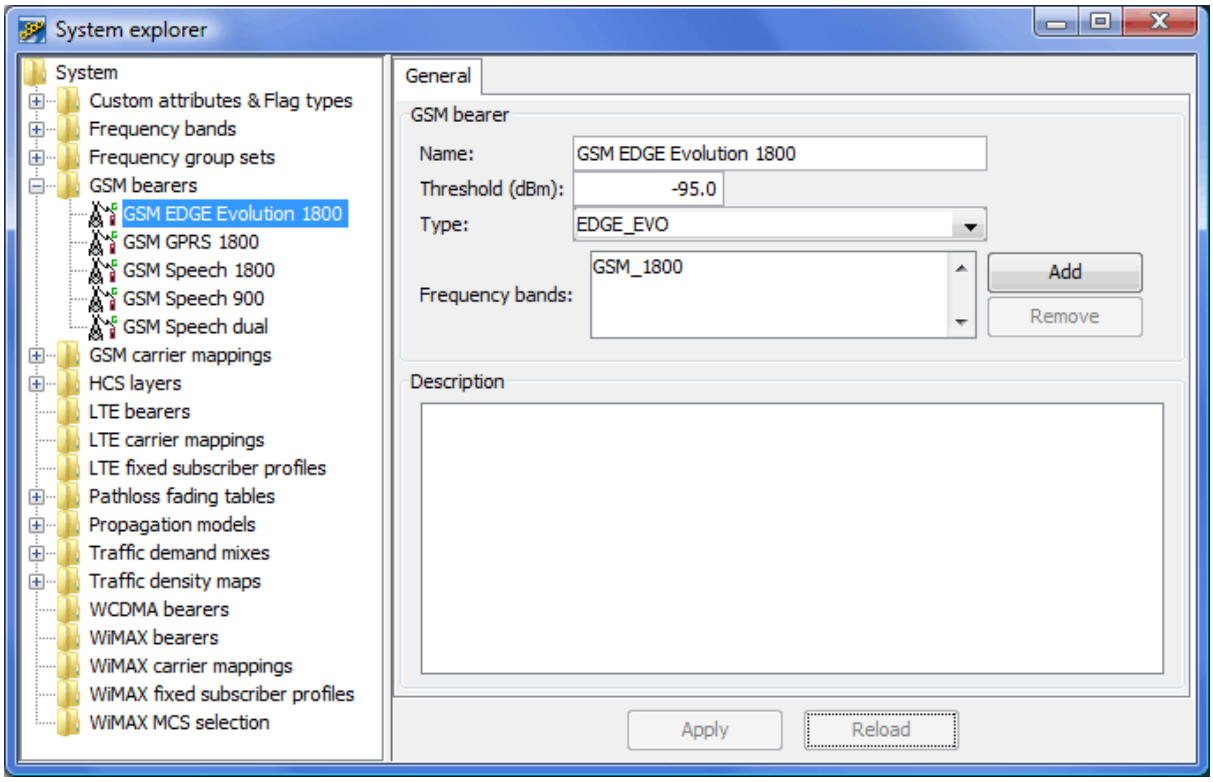
The frequency band(s) to use must be defined and carriers selected, see GSM Frequency Bands on page 6-5.

Procedure

Follow these steps to define GSM bearers:

1. Select **Utilities↗System explorer**.
2. Right-click the **GSM Bearers** folder and select **Add GSM Bearers** from the menu. The **Select a frequency band** dialog appears.
3. If you want to extend the list of selectable frequency bands, click **Add**, select a system type in the **Select system type** dialog and click **OK**.

4. Select a frequency band and click **OK**. The **GSM bearer** tab appears with the frequency band selected in previous steps.



5. Add or change information as required, see To add more frequency bands to the GSM bearer, click **Add**, select a frequency band from the **Select a frequency band** dialog and click **OK**.
6. Click **Apply** to preserve the GSM bearer.

You can now include the GSM bearers in the terminal types, see Define GSM Terminal Types on page 7-8.

Fields on Window "GSM bearers"

Name	Name of the GSM bearer. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Threshold (dBm)	Lowest signal strength threshold of the bearer in dBm
Type	Type of bearer, one of the following: • Voice • GPRS • EGPRS • EDGE Evolution
Frequency bands	1 - 100 frequency bands may be defined per bearer
Description	Description of the GSM bearer

Propagation Models

You need to define a propagation model for each antenna branch in your project. The propagation model is considered in the pathloss calculations.

How to define the propagation models relevant for GSM is described in the *TEMS CellPlanner Common Features User's Guide*, in the following chapters:

- Define Propagation Model Types
- Ericsson 9999 Propagation Model
- Urban Propagation Model
- Okumura-Hata Propagation Model

To read more about propagation models, see chapter *Propagation Models* in the *TEMS CellPlanner Common Features Technical Reference Manual*.

To read more about antenna branches, see GSM Antenna Branch Templates on page 8-15 and Antenna Branches on page 9-33.

GSM Traffic Demands

For each bearer (or rather service type) - voice, GPRS, E-GRPS, or EDGE Evolution - you define a *traffic demand*, listing the percentage load per terminal type supporting the service type. Hence you have to define the bearers and terminal types before you can define the traffic demands.

You combine the traffic demands in a traffic demand mix, and the traffic demand mix is input to the Interference Analysis and Traffic Performance Analysis.

During analysis, the geographical distribution of terminals will be either uniform, map-based or area-based, depending on your configuration of the demand type in each traffic demand. A map-based demand requires a traffic density map to be defined in the System explorer. The area-based demand requires a map area to be defined using the area editor.

See also:

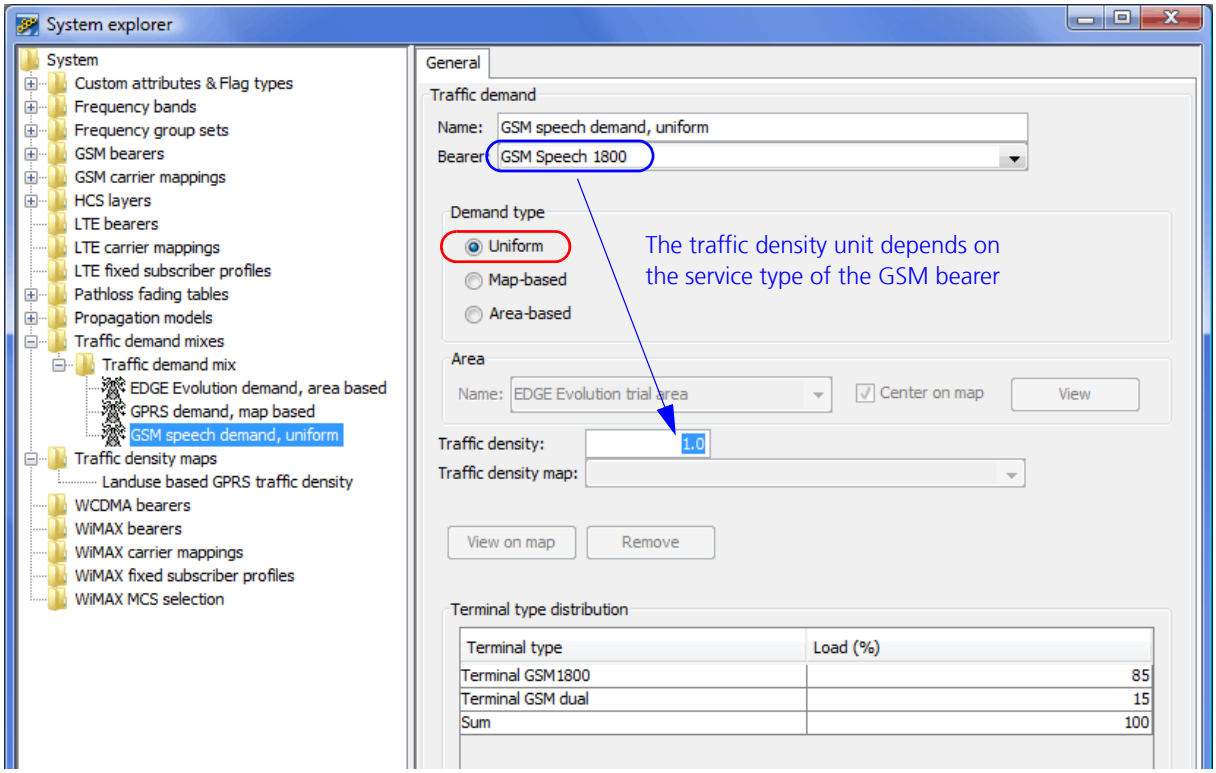
- Define GSM Bearers on page 6-14
- Define GSM Terminal Types on page 7-8
- *TEMS CellPlanner Common Features Technical Reference Manual*, chapter *Traffic Modeling* for an in-depth description and examples of traffic modeling
- *TEMS CellPlanner Common Features User's Guide* for information on how to
  - Define Traffic Demands
  - Define Traffic Density Maps
  - Define Map Area

On the subsequent pages you find examples on traffic demands for GSM:

- Example: Uniform Demand on page 6-18
- Example: Map-Based Demand on page 6-19
- Example: Area-Based Demand on page 6-20

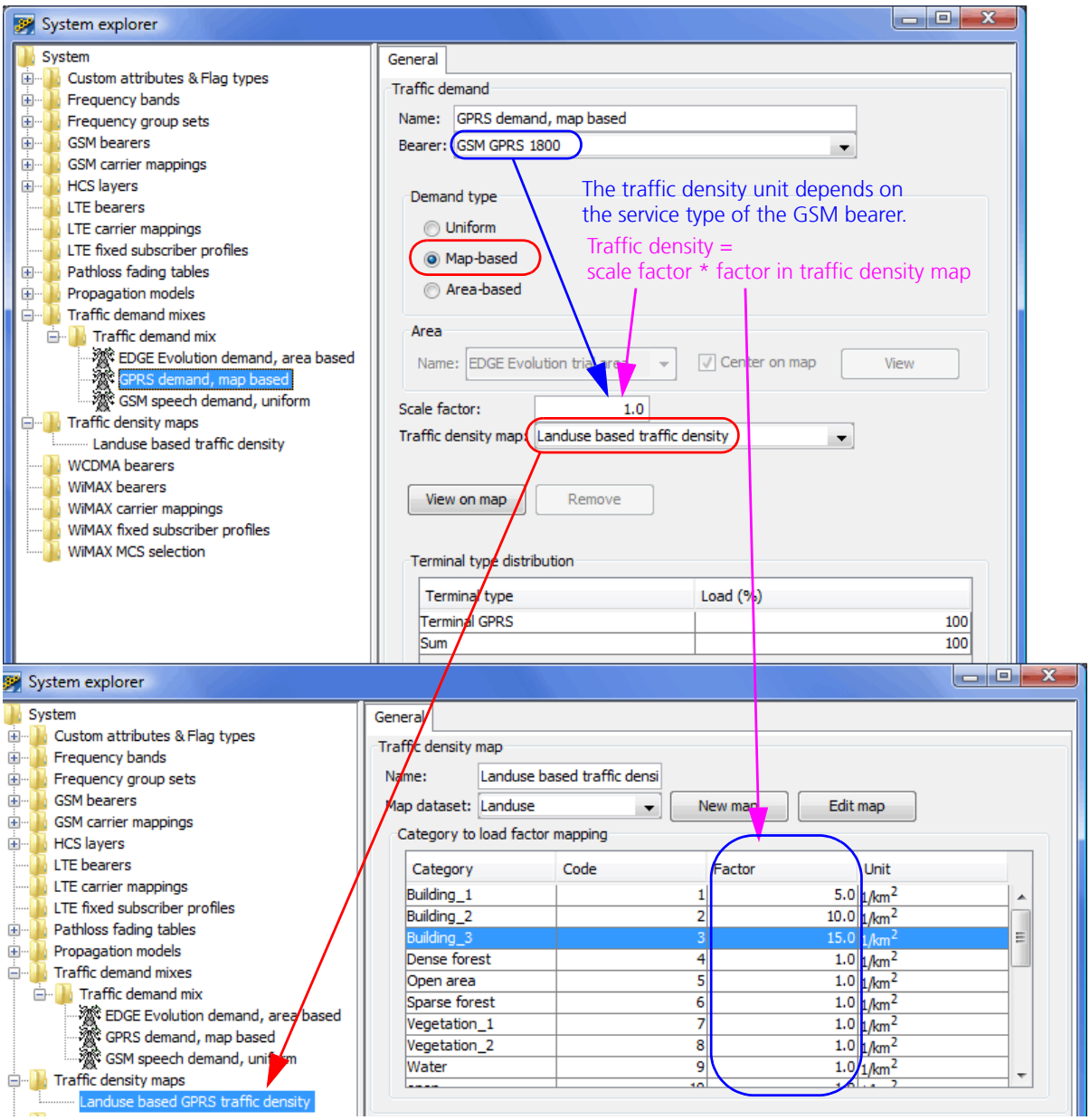
Example: Uniform Demand

Enter the traffic density. The traffic density unit for uniform demand is Erlangs/km2 for GSM CS traffic (as in the example below) or kbps/km2 for GSM PS traffic.



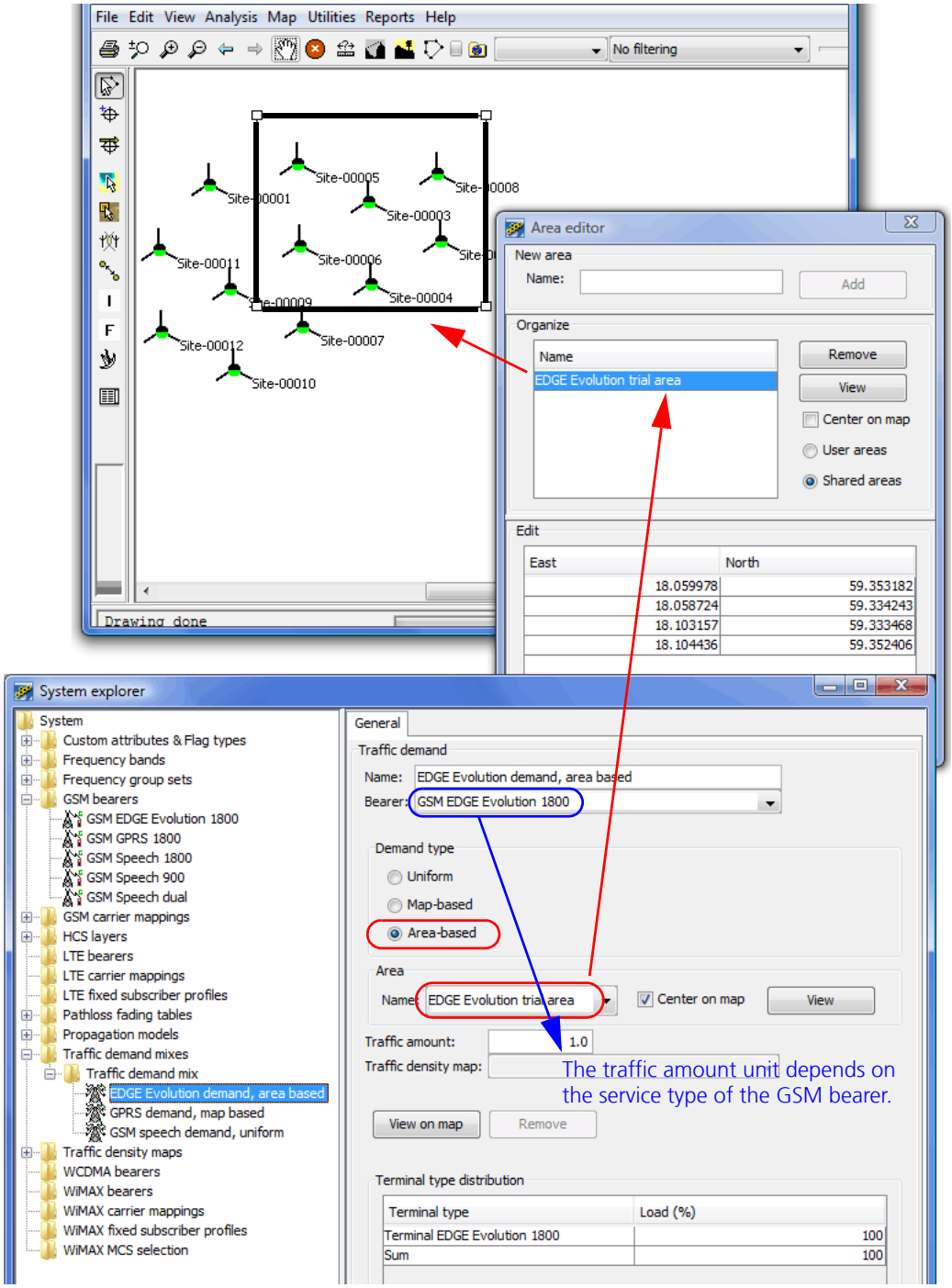
Example: Map-Based Demand

Associate the traffic demand with a traffic density map. Scale the traffic density by modifying the scale factor. The final unit of the traffic density (after multiplication) is Erlangs/km2 for GSM CS or kbps/km2 for GSM PS traffic, as in this example:



Example: Area-Based Demand

Enter the traffic amount. The specified amount of traffic will be spread over the area. The final unit of the traffic demand is Erlangs for GSM CS or kbps for GSM PS traffic as in this EDGE Evolution example:



Custom Attributes and Flag Types

Some objects in your project can be tagged with your own text or graphical attributes to be shown in the plots.

The following GSM custom attributes are predefined in the System Explorer:

- GSM RBS attributes
- GSM cell attributes

See C*ustomizing Attributes for Sites, RBSs and Cells* in the *TEMS CellPlanner Common Features User's Guide*.

7
GSM Equipment Types

This chapter describes how to define the equipment types of a GSM network.

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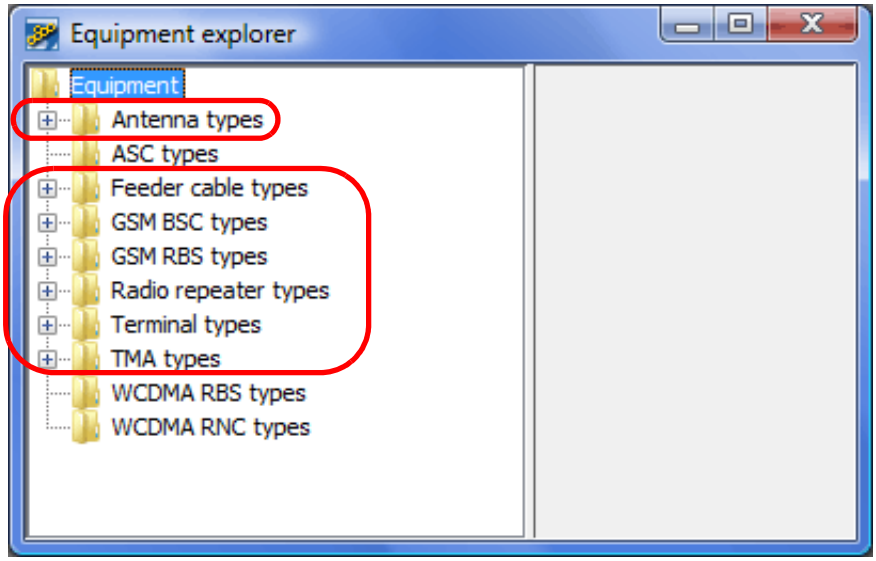
About GSM Equipment Types 7-2
Antenna Types. 7-3
TMA Types (Optional) 7-3
Feeder Cable Types (Optional) 7-3
GSM BSC Types. 7-4
Define GSM BSC Types. 7-4
GSM RBS Types 7-6
Define GSM RBS Types 7-6
GSM Terminal Types 7-8
Define GSM Terminal Types 7-8
Configure GSM Terminal Type 7-9
Radio Repeater Types. 7-11

About GSM Equipment Types

Before adding sites and cells with physical *equipment* to your network project, you need to define the *equipment types* to be used. The equipment types include data about vendor, product id and so on.

You can add or delete equipment types using the right-click mouse menus in the **Equipment explorer**. In the figure below, the equipment types relevant for GSM are highlighted:



The standard flow of planning equipment types in a GSM network with TEMS CellPlanner is reflected in the order of procedures in this chapter. The list below shows this standard flow, in a recommended order:

1. Antenna types
2. TMA types (optional)
3. Feeder cable types (optional)
4. GSM BSC types
5. GSM RBS types
6. GSM terminal types
7. Radio repeater types

The GSM specific equipment types, marked with bold in the list above, are described in this manual. The equipment types common for several technologies are described in the *TEMS CellPlanner Common Features User's Guide*.

The actual addition of *equipment* based on these *equipment types* is described in GSM Sites, RBSs and Cells on page 9-1 and GSM Networks on page 10-1.

Antenna Types

You can define the GSM antenna types either manually or by import from antenna files.

The recommended method is to import pre-defined antenna types, see *Import EET/Planet 2.x Antennas* in the *TEMS CellPlanner Common Features User's Guide*.

If you prefer defining the antennas manually, follow the instructions in the *TEMS CellPlanner Common Features User's Guide*, chapters:

- Define Antenna Types
- Specify Antenna Bands
- Define Antenna Lobes
- Define Antenna Horizontal Patterns
- Define Antenna Vertical Patterns

TMA Types (Optional)

See *Define TMA Types* in the *TEMS CellPlanner Common Features User's Guide*.

Feeder Cable Types (Optional)

See *Define Feeder Cable Types* in the *TEMS CellPlanner Common Features User's Guide*.

GSM BSC Types

Define GSM BSC Types

Your GSM network plan will include BSCs of one or more types. The BSC types will be part of the real BSCs you define for the sites.

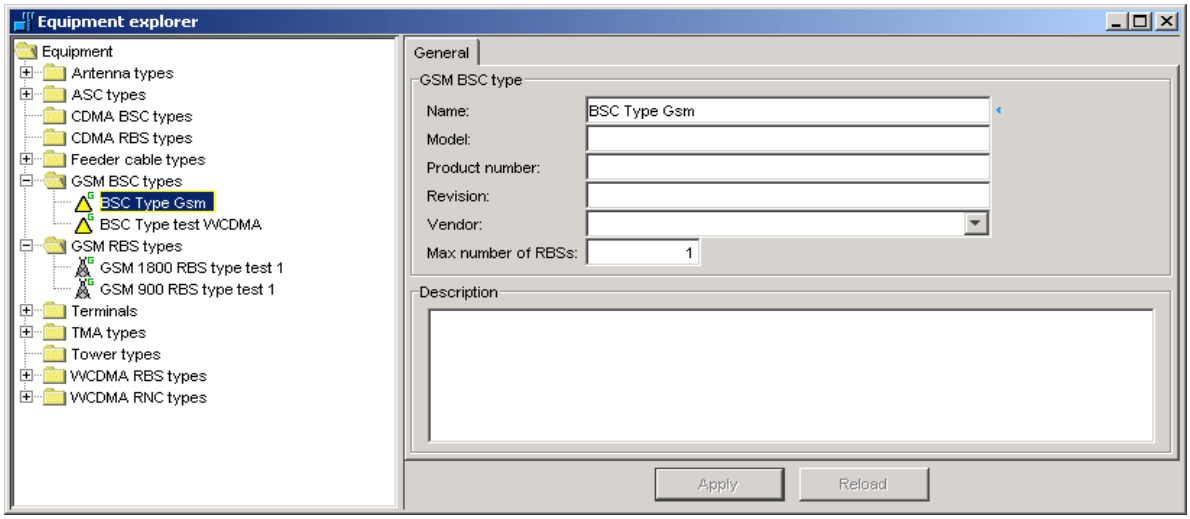
For each BSC type to be used, you need to define its product information to facilitate identification of the site equipment from the network plan.

Prerequisites

- A GSM project is open.
- The product information of each GSM BSC type to define is available, see Fields on Window "GSM BSC type" on page 7-5.

Procedure

1. From the **Utilities menu, click Equipment explorer**.
2. Right-click the **GSM BSC types** folder and select **Add GSM BSC type**.
3. The **GSM BSC type - General** tab appears.



4. Add or change the information as required, see GSM RBS Types on page 7-6.
5. Click **Apply** to include the information in the project.

Fields on Window “GSM BSC type”

Name	Name of the BSC type. This name is used at export to and import from XML cell data. The BSC name determines the XML file name for the BSC when you export data from TEMS CellPlanner. For example, a BSC with the name of 96 will create an XML file with the name BSC_96.xml. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Model	Model number of the BSC
Product number	Product number of the BSC
Product revision	Product revision number of the BSC
Vendor	Manufacturer of the BSC
Max Number of RBSs	Maximum GSM RBSs that can be managed by the BSC. Range 0 - 800.
Description	Description of the BSC type

GSM RBS Types

Define GSM RBS Types

Your GSM network plan will include a number of RBSs of one or more types. The RBS types will be part of the real RBSs you define for the sites.

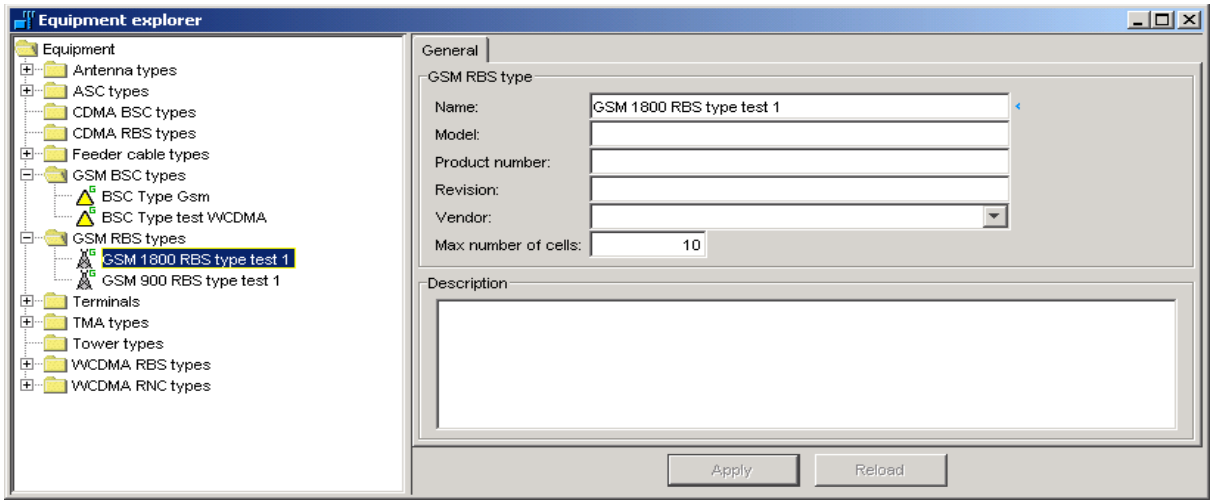
For each RBS type to be used, you need to define its product information to facilitate identification of the site equipment from the network plan.

Prerequisites

- A GSM project is open.
- The product information of each GSM RBS type to define is available, see Fields on Window "GSM RBS type" on page 7-7.

Procedure

1. From the **Utilities menu, click Equipment explorer**.
2. Right-click the **GSM RBS types** folder and select **Add GSM RBS**.
3. The **GSM RBS type - General** tab appears.



4. Add or change information as required.
5. Click **Apply** to include the information in the project.

Fields on Window “GSM RBS type”

Name	Name of the GSM RBS type. This name is used at export to and import from cells text files (Excel) and XML cell data. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Model	Model number of the RBS
Product number	Product number of the RBS
Product revision	Product revision number of the RBS
Vendor	Manufacturer of the RBS
Max number of cells	Maximum number of cells that can be served by the RBS. Range 0 - 20. Default = 10.
Description	Description of the GSM RBS type.

GSM Terminal Types

A GSM network is populated by GSM terminals of various types. The capabilities of the terminal types are, as part of selected traffic cases, considered in best server calculations and other analysis functions, to increase the accuracy of the predictions. See About Traffic Cases on page 15-3 for more information about terminal types in traffic cases.

Terminal Moving Speed

The moving speed of a terminal can be of either type:

- **Fast** - supporting GSM voice bearers. A fast terminal is not HCS capable, and always selects the strongest cell (Basic ranking)
- **Slow** - supporting all GSM bearers. A slow terminal is HCS capable, and selects the cell with the highest HCS priority (HCS ranking).

For details on slow and fast terminals, see the *GSM Technical Reference Manual*.

Suggestion: Mix of Terminal Types

To simulate the mix of subscribers in a real GSM network, you can define three terminal types:

- an outdoor slow terminal with low loss (body loss only)
- an in-car fast terminal with in-car loss added
- an indoor slow terminal with high loss (building penetration loss added)

Define GSM Terminal Types

Define the most common GSM terminal types assumed to appear in your GSM network. The terminal types are part of the traffic cases used in the GSM Analysis.

For a minimal mix of terminals, see Suggestion: Mix of Terminal Types on page 7-8.

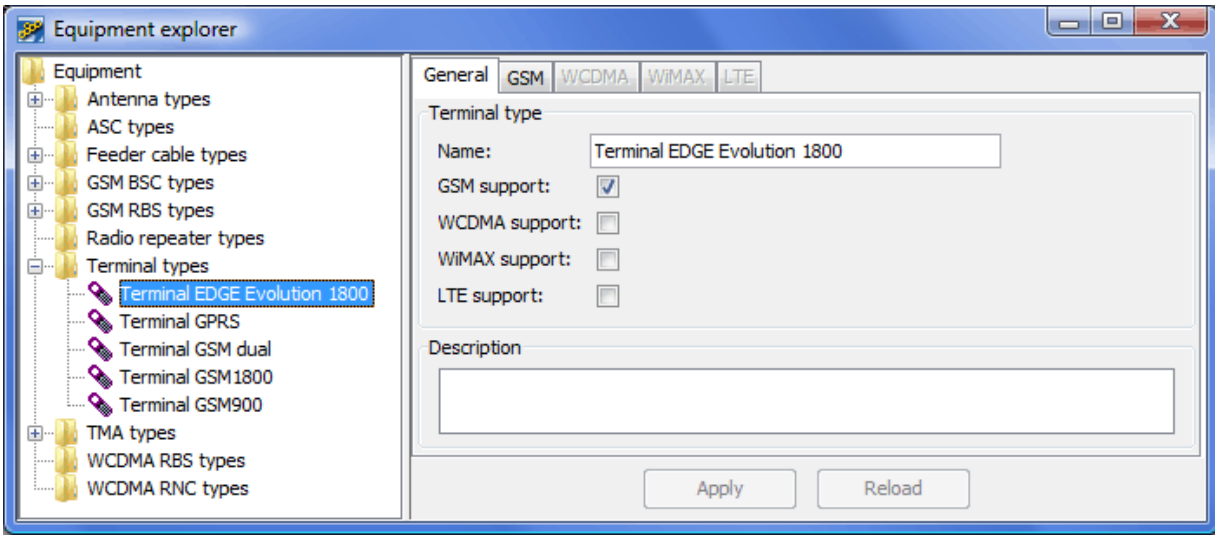
Prerequisites

A GSM project is open.

Procedure

1. From the **Utilities** menu, click **Equipment explorer**.
2. Right-click the **Terminal types** folder and select **Add Terminal**.
3. The **Terminal types - General** tab window appears.
4. Assign the name of the terminal type.

5. Select **GSM support**. The GSM tab becomes enabled as in the example below:



6. Click **Apply**.
7. Proceed with Configure GSM Terminal Type on page 7-9.

Fields on Window "Terminal types - General"

Name	Name of the terminal type. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %. Assign an easily recognized name, for example including the terminal's brand and capabilities.
Antenna height	Height of terminal antenna, above ground level. Range 0 - 100. Default = 1.5.
GSM support	Indicates that the terminal type supports GSM technology
WCDMA support	Indicates that the terminal type supports WCDMA technology
Description	Description of the terminal type (optional).

Configure GSM Terminal Type

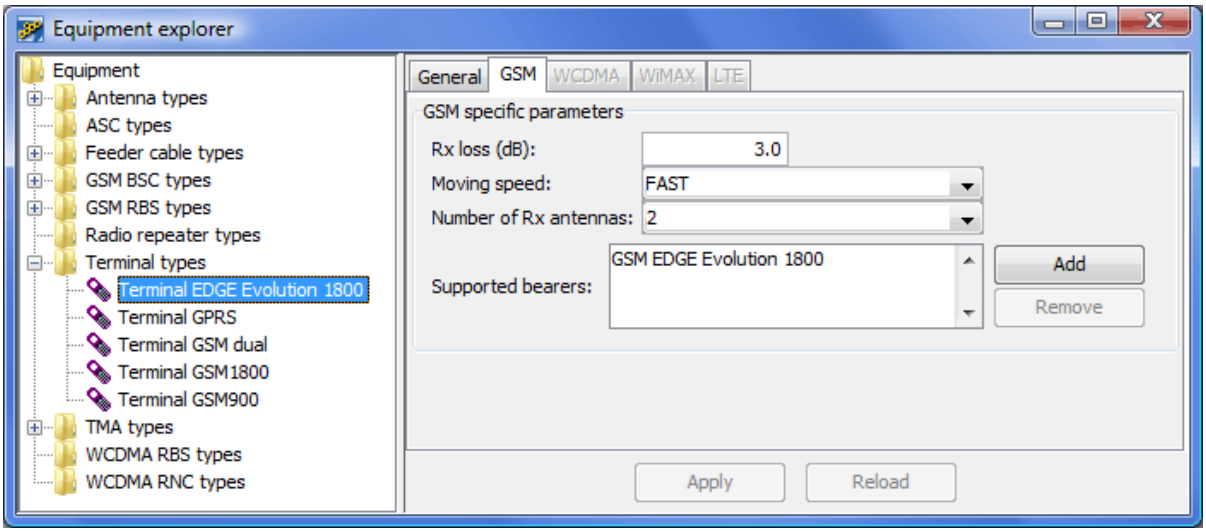
Each GSM terminal type is characterized by its moving speed, Rx loss and supported bearers. You need to assign these parameters to give correct input to the analysis.

Prerequisites

- GSM Terminal Types are defined
- GSM Bearers are defined
- The Rx loss and Terminal Moving Speed of the GSM terminal type are known.

Procedure

1. From the **Utilities** menu, click **Equipment explorer**.
2. From the left-hand browser window, select the terminal type to configure.
3. From the right-hand menu, select the **GSM** tab. The **GSM specific parameters** window appears as in the following example:



4. Change the parameter values as required.
5. Click **Apply**.

Fields on Window "Terminal types - GSM specific parameters"

Rx loss (dB)	Reception loss. The sum of losses such as body loss, building penetration loss, and feeder loss from an external terminal antenna. Normally there is no need to model reception loss of terminals. Range 0 - 50. Default = 3dB (body loss).
Moving speed	Terminal Moving Speed, either of: • Slow - HCS capable • Fast - not HCS capable
Number of Rx antennas	EDGE Evolution terminal may have 2 Rx antennas. Range: 1 - 2. Default = 1.
Supported bearers	Bearers supported by this terminal type
Add	Adds a bearer to the list of supported bearers
Remove	Removes a selected bearer from the list of supported bearers

Radio Repeater Types

See *Define Radio Repeater Types* in the *TEMS CellPlanner Common Features User's Guide*.

8
GSM Templates

This chapter describes how to define the templates of a GSM network plan.

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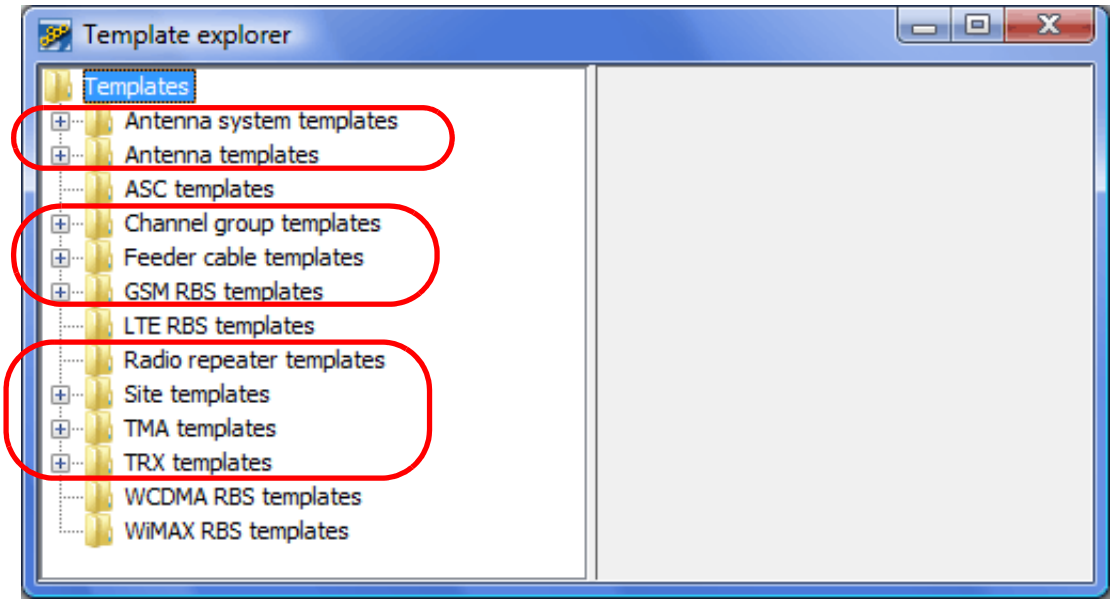
About GSM Templates

You can save time by using templates when you build your network plan. The templates define default parameter values to be inherited by network elements defined after definition of the templates.

Note: *Changes in templates do not affect already created network elements based on templates.*

You can add or delete templates using the right-click mouse menus in the **Template explorer**. In the figure below, the top level templates relevant for GSM are highlighted:

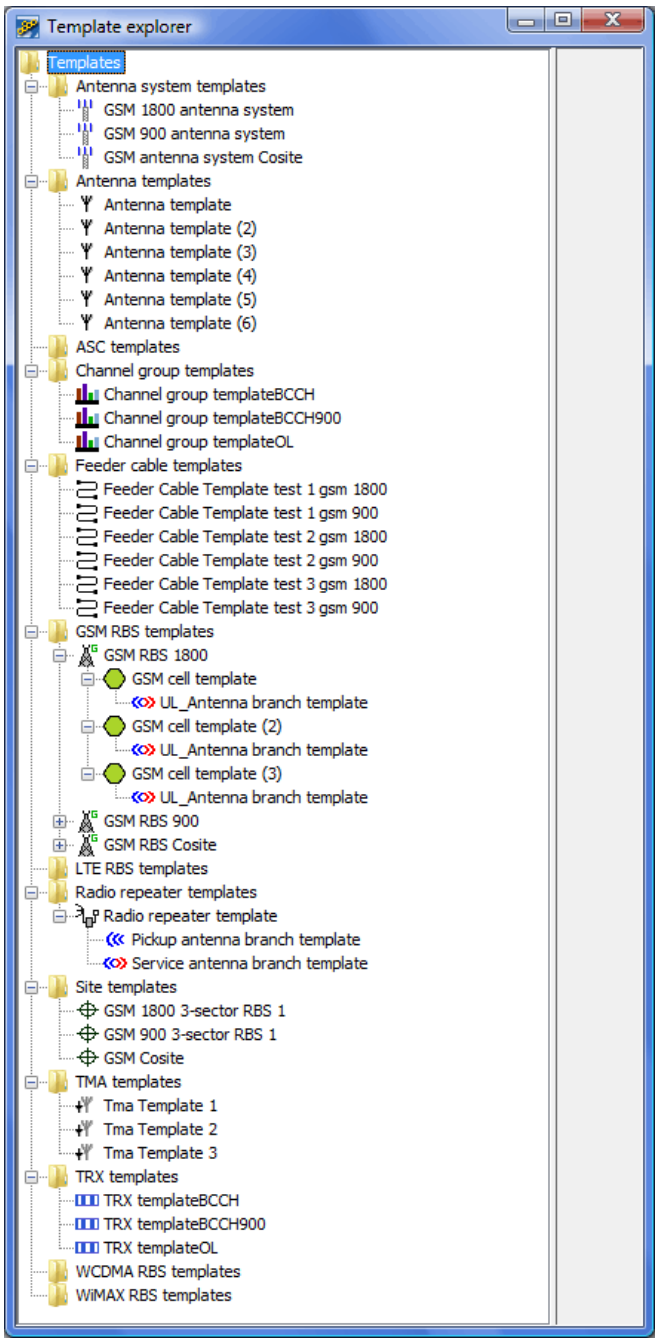


The standard flow of defining GSM templates with TEMS CellPlanner is reflected in the order of procedures in this chapter. The list below shows this standard flow, in the recommended order:

1. Antenna
2. TMA
3. Feeder cable
4. Antenna system
5. **TRX, Channel group**
6. **GSM RBS, GSM cell, GSM overlaid sub-cell, antenna branch**
7. Radio repeater, including antenna branch templates for pickup and service
8. Site

The GSM specific templates, marked with bold in the list above, are described in this manual. The templates common for GSM and other technologies are described in the *TEMS CellPlanner Common Features User's Guide*.

Some GSM templates are parts of higher level templates. In the example below, sub-level templates for GSM 900 cells, GSM 1800 cells, GSM co-site cells and GSM 1800 repeaters are defined:



Example: How to Organize GSM Templates

A suggested method is to organize GSM templates for the RBS types to use in the GSM network plan. The following example describes templates for a three-sector RBS:

Templates	Recommended Template Configurations
Define three antenna templates	Name them: • "GSM 900 A" • "GSM 900 B" • "GSM 900 C" Set different azimuths in each template, for example 0, 120, 240 (or other appropriate azimuth angles). Antenna types must be imported.
Define antenna system template	Name it "GSM antsys", and add the three imported antennas
Define two TRX templates	• One BCCH TRX (select the BCCH check box) • One TCH TRX (leave the "BCCH" check box empty)
One channel group template	Add a BCCH TRX template and a TCH TRX template, and tick the "BCCH" box, for use in every cell or underlaid sub-cell. If your network uses overlaid sub-cells, add another Channel Group template to be used by every overlaid sub-cell, add a TCH TRX template, but un-check the "BCCH" box.
Define a GSM RBS template	Name it "GSM 900 RBS"
Define three cell templates	In each cell, add a Channel Group template for a cell (or underlaid sub-cell)
Define three antenna branch templates	For each antenna branch template, include the appropriate antenna. An antenna branch template may be defined for a cable repeater antenna branch. You must then select the cable repeater option.
Define a site template	Name it "GSM 900 RBS-3" and connect or link it to your GSM RBS template

You may create several RBS templates in the same way, using different frequency bands and antennas. In each template, enter appropriate values for the output power and maximum timing advance.

Antenna Equipment Templates

Antenna Templates

See *Define Antenna Templates* in the *TEMS CellPlanner Common Features User's Guide*.

TMA Templates (Optional)

See *Define TMA Templates* in the *TEMS CellPlanner Common Features User's Guide*.

Feeder Cable Templates (Optional)

See *Define Feeder Cable Templates* in the *TEMS CellPlanner Common Features User's Guide*.

Antenna System Templates

The antenna system template is a container of sets of the following templates:

- Antenna template
- TMA template
- Feeder cable template

You thus need to define the above templates before defining an antenna system template.

One antenna system template can include a multiple number of each of the templates above, for example three antenna templates and two TMA templates. The final selection of which one of each template to use is done per antenna branch, see Define GSM Antenna Branch Template (Underlaid Sub-Cell) on page 8-15.

As an example, consider the case of an antenna system template for GSM 1800. This template shall include templates of all antennas, TMAs and feeder cables that you are allowed to plan for GSM 1800.

Note: *TMAs are part of GSM antenna systems, while ASCs are relevant for WCDMA antenna systems only.*

See *Define Antenna System Templates* in the *TEMS CellPlanner Common Features User's Guide*.

TRX and Channel Group Templates

You can speed up the definition of GSM cells by defining channel group templates including BCCH TRX and TCH TRX templates.

Define TRX Templates

You can define TRX templates for BCCH and TCH. These templates optionally include the frequency group number within its technology.

The TRX templates are included in the channel group templates, see Define Channel Group Templates on page 8-6.

Prerequisites

If frequency group sets are defined, a frequency group per template can be selected. See Define Frequency Group Sets on page 6-10.

Procedure

1. Select **Utilities↗Template explorer**.
2. Right-click the **TRX templates** folder, and select **Add TRX template**.
   A TRX network element is created under **TRX templates**.
3. Enter `BCCH` as name of the TRX template and select the **BCCH** option.
4. If frequency groups are defined, select the desired frequency group for BCCH.
5. Click **Apply** to preserve the BCCH TRX template.
6. Right-click the **TRX templates** folder, and select **Add TRX template**.
   A TRX network element is created under **TRX templates**.
7. Enter `TCH` as name of the TRX template and clear the **BCCH** option.
8. If frequency groups are defined, select the desired frequency group for TCH.
9. Click **Apply** to preserve the TCH TRX template.

Define Channel Group Templates

A channel group template includes TRX templates and defines the hop type and time slots for GPRS and EGPRS. If your network plan uses synthesizer hopping, the MAIO numbers and HSN shall also be defined here.

Channel groups are used to assign frequencies to GSM cells or overlaid/underlaid sub-cells. They can also be used to assign all or selected parts of one or more frequency groups belonging to the same or different frequency group sets.

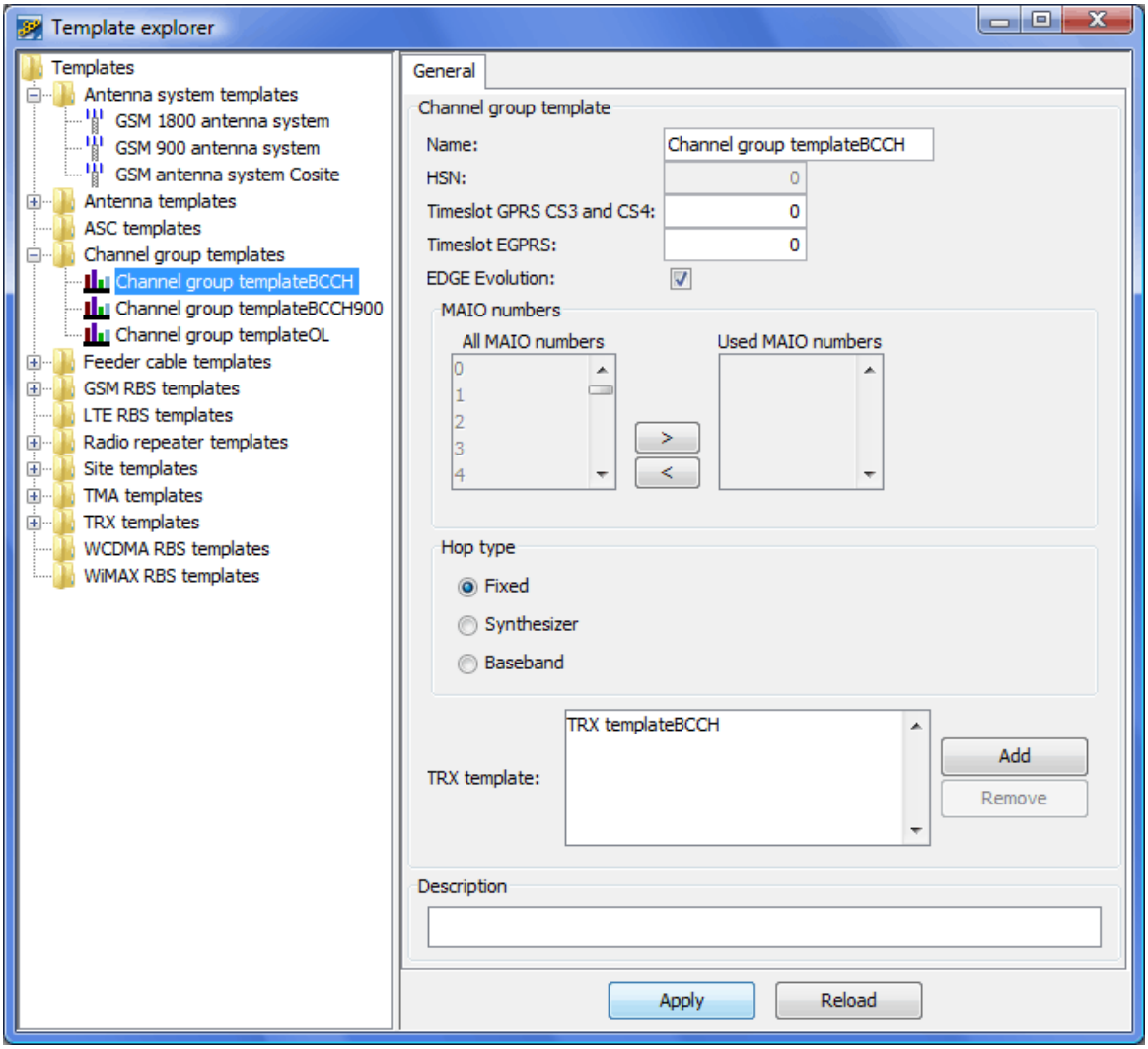
The channel group templates are included in the GSM cell templates, see Define GSM Cell Templates on page 8-10.

Prerequisites

TRX templates for BCCH and TCH are defined, see Define TRX Templates on page 8-6.

Procedure

1. Select **Utilities↗Template explorer**.
2. Right-click the **Channel group templates** folder, and select **Add Channel group template**. The **Select a TRX template** dialog appears.
3. Select a TRX template and click **OK**. The **Channel group template** appears.



4. Enter the parameters as required.
5. Click **Apply** to preserve the channel group template.

Fields on Window “Channel group template”

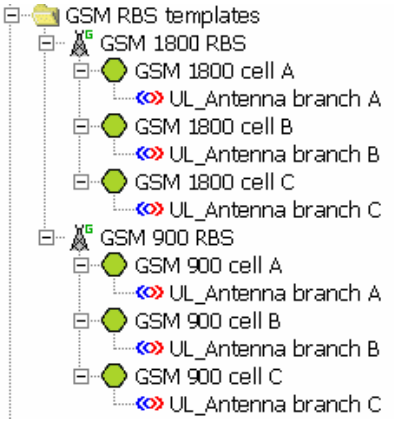
Name	Name of the channel group template. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
HSN	Hopping sequence number (HSN) used for the frequency group when hop type synthesizer is selected
Timeslot GPRS CS3 and CS4	Number of timeslots used for GPRS CS3 and CS4 (coding scheme 3 and 4)
Timeslot EGPRS	Number of timeslots used for EGPRS
EDGE Evolution	Indicates the cell is EDGE Evolution capable
MAIO numbers	
All MAIO numbers	Relevant when hop type synthesizer is selected. All MAIO numbers available for the channel group.
Used MAIO numbers	Relevant when hop type synthesizer is selected. Selected MAIO numbers used in the channel group.
Hop type	
Fixed	Select to enable fixed frequency
Synthesizer	Select to enable synthesizer hopping. If selected, the sub-parameters SDCCH no hopping shall be selected or cleared.
Baseband	Select to enable baseband frequency hopping. If selected, the sub-parameters SDCCH no hopping shall be selected or cleared.
TRX template	A list of TRX templates. The template chosen in the beginning of the procedure is included here. You can add or delete other templates to the list.

GSM RBS and Cell Templates

You can save time defining GSM cells by using templates for GSM RBSs and GSM cells in a GSM network plan including:

- many RBSs with the same antenna system equipment and cell configuration
- many cells with the same cell parameters and antenna branch settings

As an example, a network plan with one GSM 1800 RBS, one GSM 900 RBS, one cell per RBS and one antenna branch per cell looks as follows in the Template explorer:



Define GSM RBS Templates

A GSM RBS templates hosts GSM cell templates, which in their turn host antenna branch templates.

Prerequisites

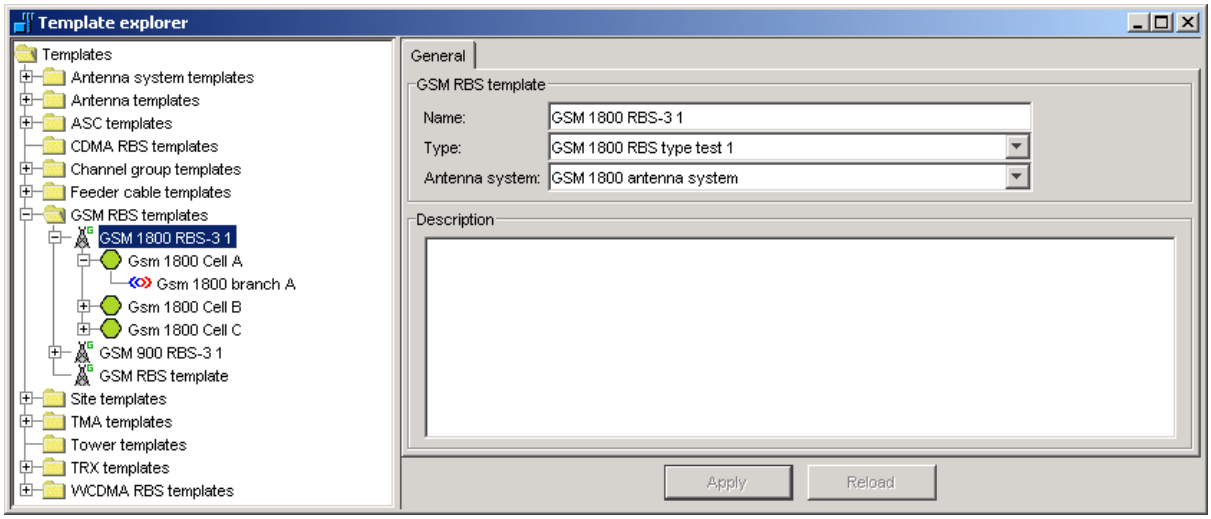
- The GSM RBS type to use is defined, see Define GSM RBS Types on page 7-6.
- The antenna system template to use is defined, see Antenna System Templates on page 8-5.

Procedure

Follow these steps to define GSM RBS templates:

1. Select **Utilities↗Template explorer**, and highlight the **GSM RBS template** folder.

2. Right-click the folder, and select **Add GSM RBS template**. The **GSM RBS template** window appears:



3. Enter the name of the GSM RBS template.
4. Select the antenna system to associate with this GSM RBS template.
5. Enter a description of the GSM RBS template.
6. Select the GSM RBS type.
7. Click **Apply** to preserve the GSM RBS template.
8. Proceed with Define GSM Cell Templates on page 8-10.

Fields on Window "GSM RBS template"

Name	Name of the GSM RBS. Defaults to "New GSM RBS template". Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Antenna system	Antenna system associated with the GSM RBS template
GSM RBS Type	List of available GSM RBS types for the template
Description	Description of the GSM RBS template

Define GSM Cell Templates

A GSM cell template is a sub-template of a GSM RBS template. It defines among other the channel group templates and the frequency band to use. It can also be configured to define a default overlaid sub-cell.

The GSM cell template hosts antenna branch templates.

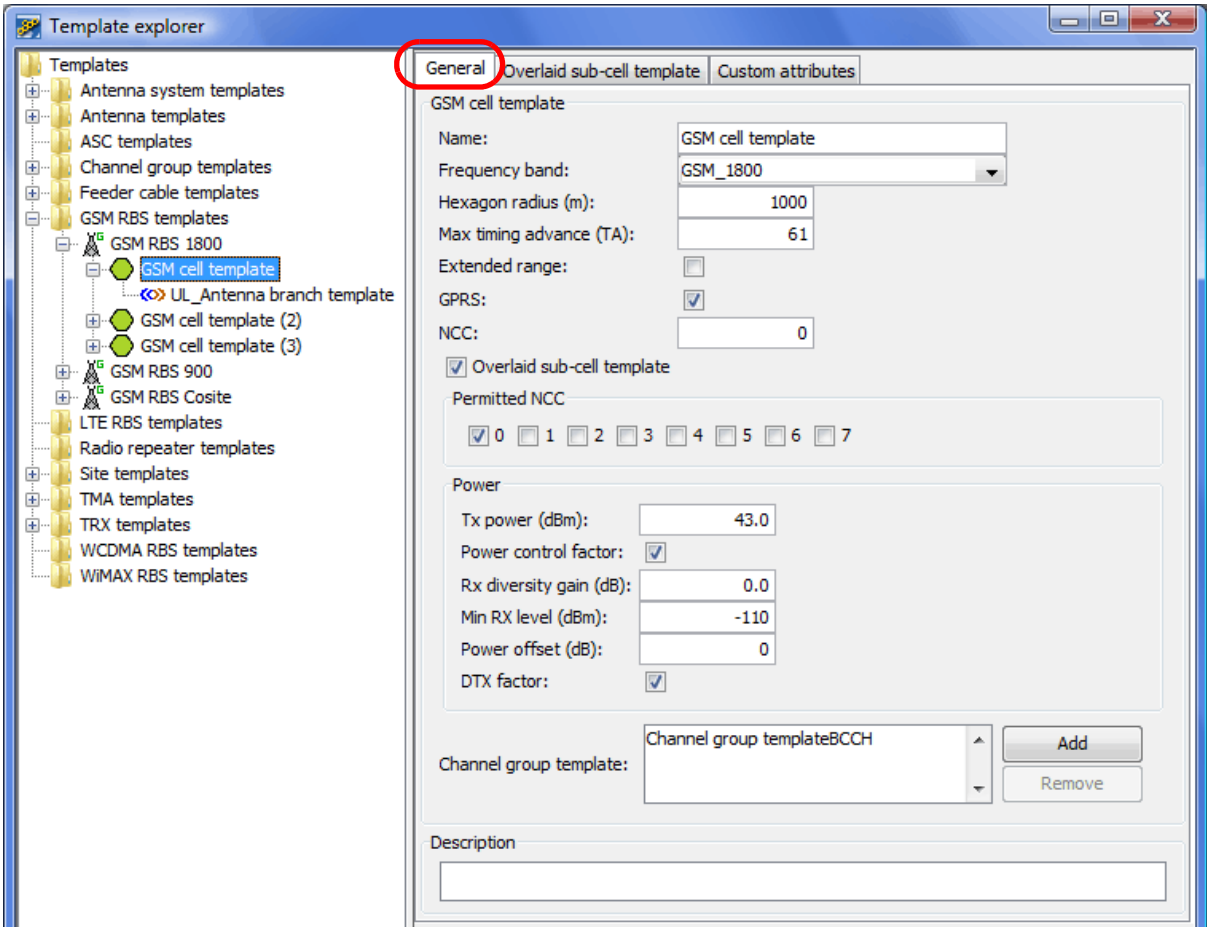
Prerequisites

- The GSM RBS template to host this cell template is defined, see Define GSM RBS Templates on page 8-9
- The frequency band to use is defined, see Define GSM Frequency Bands on page 6-5.
- The channel group templates to use are defined, see Define Channel Group Templates on page 8-6.

Procedure

Follow the steps below to define GSM cell templates:

1. Select **Utilities↗Template explorer**, and highlight a GSM RBS template.
2. Right-click the GSM RBS template, and select **Add GSM cell template**. The window of the **General** tab appears.



3. Enter the parameters of the GSM cell template, see Fields on Window "GSM cell template".

Note: *If the cell uses overlaid/underlaid cell structure, the parameters you enter under this tab belong to the underlaid cell.*

4. If the cell uses overlaid/underlaid cell structure, select **Overlaid sub-cell template** to enable the corresponding tab, then follow the instructions in Configure GSM Overlaid Sub-Cell Templates on page 8-13.
5. Proceed with Define GSM Antenna Branch Template (Underlaid Sub-Cell) on page 8-15.

Fields on Window "GSM cell template"

Name	Name of the GSM cell template. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Frequency band	The frequency band used for the cell. Must be the same as the frequency band assigned to the antenna branch template, see GSM Antenna Branch Templates on page 8-15.
Hexagon radius (m)	The hexagon radius when displaying the cell as a hexagon on the map.
Max timing advance	Maximum allowed timing advance in bit periods. Range: 0 - 219. Default = 63
Extended range	The maximum timing advance can exceed 63.
GPRS	Indicates if the cell has GPRS capabilities. Affects Traffic Performance Analysis.
NCC	Network color code (NCC) for the cell.
Overlaid sub-cell template	Indicates that the template should include information for an overlaid sub-cell.
Permitted NCC	Permitted network color code (NCC) for the cell.
Power	
Tx power (dBm)	Transmission power in dBm of the cell. Affects received signal strength in Best Server Analysis.
Power control factor	Indicates that the cell uses downlink power control. The interference is then reduced by the power control factor, defined in Configure GSM Project Parameters on page 4-4. Affects Interference Analysis.
Rx diversity gain (dB)	Gain in dB added to the received signal due to spatial antenna diversity
Min RX level (dBm)	Ericsson-specific minimum quality received GSM level in dBm
Power offset (dB)	Power offset in dB of the cell. Not used for any calculations. Mapped to `SSOFFSETDL` at Import and Export of GSM Carriers.
DTX factor	Indicates that the cell uses downlink discontinuous transmission (DTX). The interference is then reduced by the DTX factor, defined in Configure GSM Project Parameters on page 4-4. Affects Interference Analysis.
Channel group template	Channel group template(s) to use with the cell template
Description	Description of the GSM cell template

Configure GSM Overlaid Sub-Cell Templates

This procedure is applicable if the GSM cell uses overlaid/underlaid cell structure. The overlaid sub-cell may use the same, or another, frequency band as its underlaid sub-cell. As the frequency bands may differ, the overlaid sub-cell must have its own template, even when the same frequency band as in the underlaid sub-cell is used.

Read more About GSM Overlaid/Underlaid Sub-cells on page 9-7.

Prerequisites

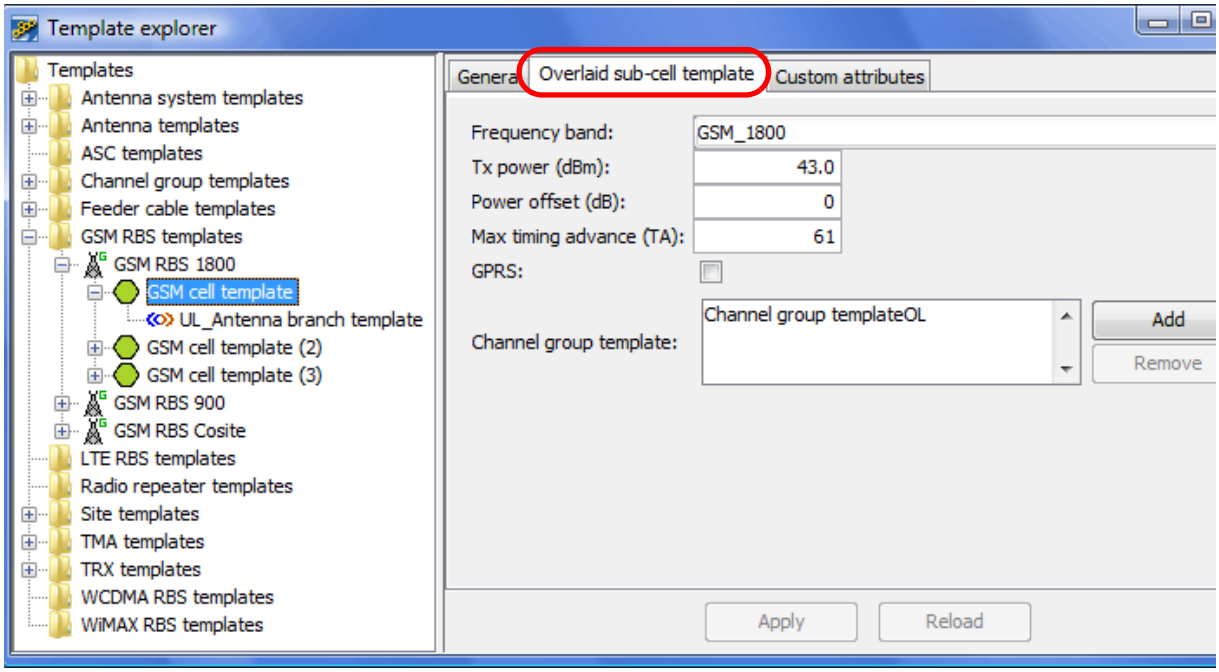
- The GSM cell template to host this sub-cell template is defined, see Define GSM Cell Templates on page 8-10.
- The parameters of the underlaid cell are defined in the window of the General tab, see Define GSM Cell Templates on page 8-10.
- The option **Overlaid sub-cell template** in the window of the General tab is selected.
- The frequency band of the overlaid sub-cell is defined, see on page 6-5.
- The channel group template to use is defined, see Define Channel Group Templates on page 8-6.

Procedure

Follow these steps to configure an overlaid sub-cell template:

1. Select **Utilities↗Template explorer**.
2. Expand the GSM RBS template hosting the GSM cell template defining the underlaid cell.
3. Select the GSM cell template.

4. Ensure that the **Overlaid sub-cell template** tab is selected.



5. Select the frequency band to associate with the overlaid sub-cell template.
6. Select a channel group template to associate with the overlaid sub-cell template.
7. Enter the other parameters for the overlaid sub-cell template.
8. Click **Apply** to preserve the overlaid sub-cell template.

Fields on Window "Overlaid sub-cell template"

Frequency band	Frequency band for the overlaid sub-cell
Tx power (dBm)	Transmission power in dBm of the overlaid sub-cell. Affects received signal strength in Best Server Analysis. Range: 0 - 80. Default = 43.0
Power offset (dB)	Power offset in dB for the overlaid sub-cell. Default = 0. Not used for any calculations. Mapped to `SSOFFSETDL` at Import and Export of GSM Carriers.
Max timing advance	Maximum allowed timing advance in bit periods. Range: 0 - 219. Default = 63
GPRS	Enables GPRS in the overlaid sub-cell. Default = No.
Channel group template	Channel group template to use with the overlaid sub-cell template.
Description	Description of the overlaid sub-cell template.

GSM Antenna Branch Templates

GSM antenna branch templates save you time when your GSM network plan includes many sites with the same propagation model and antenna equipment.

About Antenna Branches

A GSM antenna branch is part of a GSM cell. It defines among other the propagation model and the antenna type, feeder cable and TMA to use.

For an underlaid/overlaid (UL/OL) cell pair, the frequency band, propagation model and antenna type may be different for the underlaid and overlaid sub-cells. The parameters of particular importance for an UL/OL cell pair are described in Fields on Window "Antenna branch template" on page 8-17.

Define GSM Antenna Branch Template (Underlaid Sub-Cell)

Use this procedure to define an antenna branch template of

- an ordinary GSM cell (without overlaid sub-cell), or
- an underlaid sub-cell (with overlaid sub-cell)

If you need antenna branches for normal antennas and for cable repeaters, define a separate antenna branch template for the cable repeater.

Prerequisites

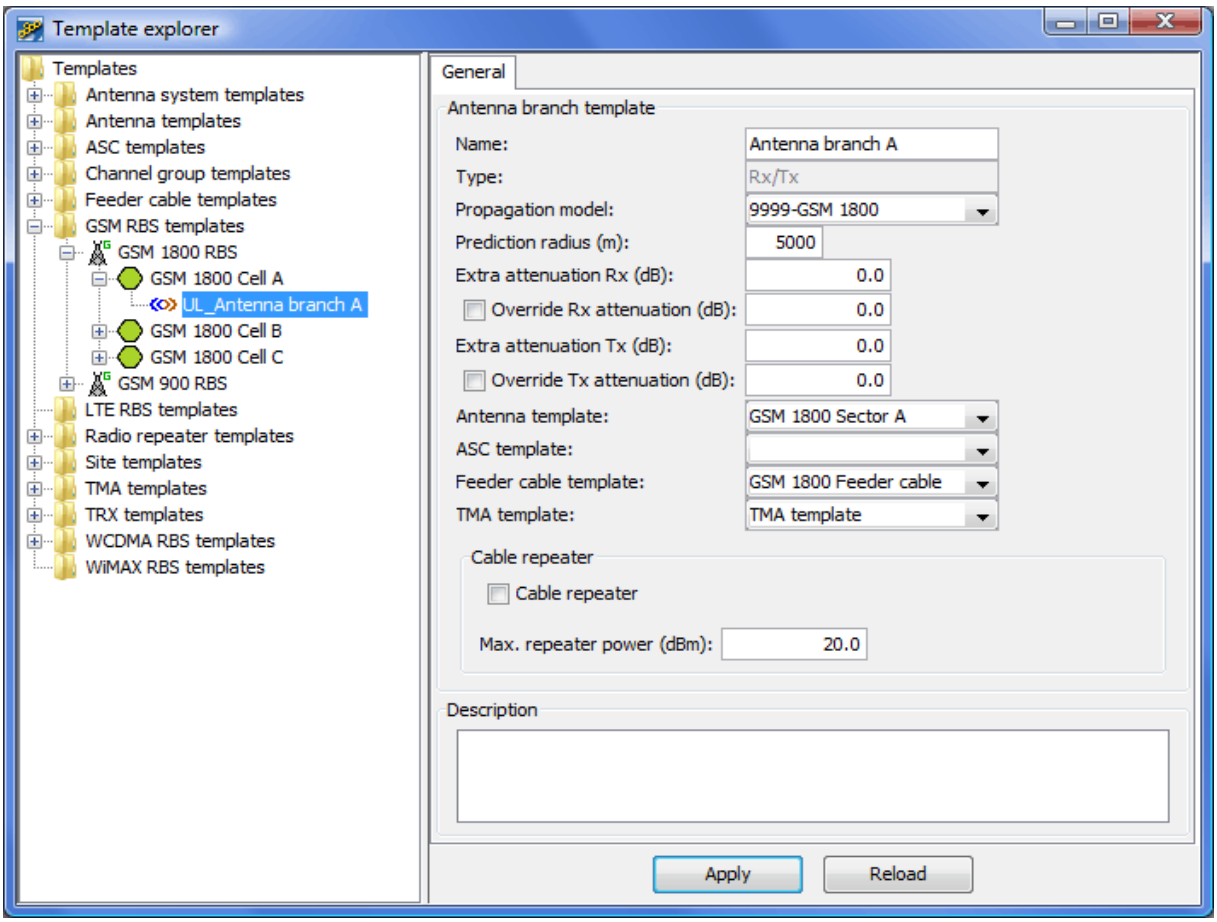
- The GSM cell template to host the antenna branch template is defined, see Define GSM Cell Templates on page 8-10.
- The propagation model is defined, see Propagation Models on page 6-16.
- The antenna template is defined, see Antenna Templates on page 8-5.
- Optionally, the TMA template is defined, see TMA Templates (Optional) on page 8-5.
- Optionally, the feeder cable template is defined, see Feeder Cable Templates (Optional) on page 8-5.

Procedure

To define an antenna branch template for ordinary GSM cells (not UL/OL) or for underlaid sub-cells, follow these steps:

1. Select **Utilities↗Template explorer**, and locate the GSM cell template in the **GSM RBS template** folder.
2. In the cell template, ensure that the option **Overlaid sub-cell template** is cleared.

3. Right-click the GSM RBS cell, and select **Add Antenna branch template**.
4. Enter information in the following sequence of dialogs:
   - Antenna template. Select an antenna template supporting the frequency band of the cell (or underlaid sub-cell).
   - Antenna branch type
   - Propagation model. Select a propagation model applicable for the frequency band of the overlaid sub-cell.
5. When all dialogs are answered, the antenna branch is created under the GSM cell, and the **Antenna branch template** window appears.



6. Select feeder cable template and TMA template, if applicable.
7. Change the other parameters as required.
8. Click **Apply** to preserve the underlaid sub-cell (or ordinary) antenna branch template.
9. If needed, proceed with Define GSM Antenna Branch Template (OL Sub-Cell of Dual-Band Cell).

Fields on Window “Antenna branch template”

Name	Name of the antenna branch template. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Type	Type of transmission of the antenna branch: Rx, Tx, or both.
Propagation model	Propagation model for the cell, selected from a list of defined models. A single-band cell must use the same propagation model in its underlaid and overlaid sub-cells. A dual-band cell may use different propagation models in its underlaid and overlaid sub-cells.
Prediction radius (m)	The maximum distance from the site to the point of prediction. Range: 0 - 200000. Default = 2000.
Extra attenuation Rx (dB)	Extra UL loss value in decibels, added to the calculated *Total Rx attenuation* in the antenna branch using this template. Range 0 - 50. Default = 0.
Override Rx attenuation	If selected, the associated attenuation value overrides the *Total Rx attenuation* in the antenna branch using this template. Range: 0 - 100. Default = 0.
Extra attenuation Tx (dB)	Extra DL loss value in decibels, added to the calculated *Total Tx attenuation* in the antenna branch using this template. Range 0 - 50. Default = 0.
Override Tx attenuation	If selected, the associated attenuation value overrides the *Total Tx attenuation* in the antenna branch using this template. Range: 0 - 100. Default = 0.
Antenna template	Antenna template used with the antenna branch. The same or different antennas may be used for an UL/OL sub-cell pair. If the same antenna is used for the overlaid and underlaid sub-cells of a dual-band cell, the antenna type must support both frequency bands.
ASC template	Antenna system controller (ASC) template, if applicable. Not relevant for GSM.
Feeder cable template	Feeder cable template, if applicable.
TMA template	Tower mounted antenna (TMA) template, if applicable.
Cable repeater	Enables use of the cable repeater parameters. If selected: • The Tx power parameter of the cell created from this template inherits the cable repeater power instead of the cell Tx power • You should give the antenna branch a name clearly showing it is a cable repeater antenna branch
Max. repeater power (dBm)	Cable repeater transmitted power. Range -40.0 - 80.0 dBm. Default = 20 dBm.
Description	Description of the antenna branch template

Define GSM Antenna Branch Template (OL Sub-Cell of Dual-Band Cell)

Use this procedure to define an antenna branch template of an overlaid sub-cell of a dual-band cell.

An overlaid sub-cell using another frequency band than its underlaid sub-cell must have its own antenna branch, as the frequency band is part of the antenna branch.

Do not use this procedure for an overlaid sub-cell of a single-band cell. In that case, the same antenna branch is used for the underlaid as well as the overlaid cell.

Prerequisites

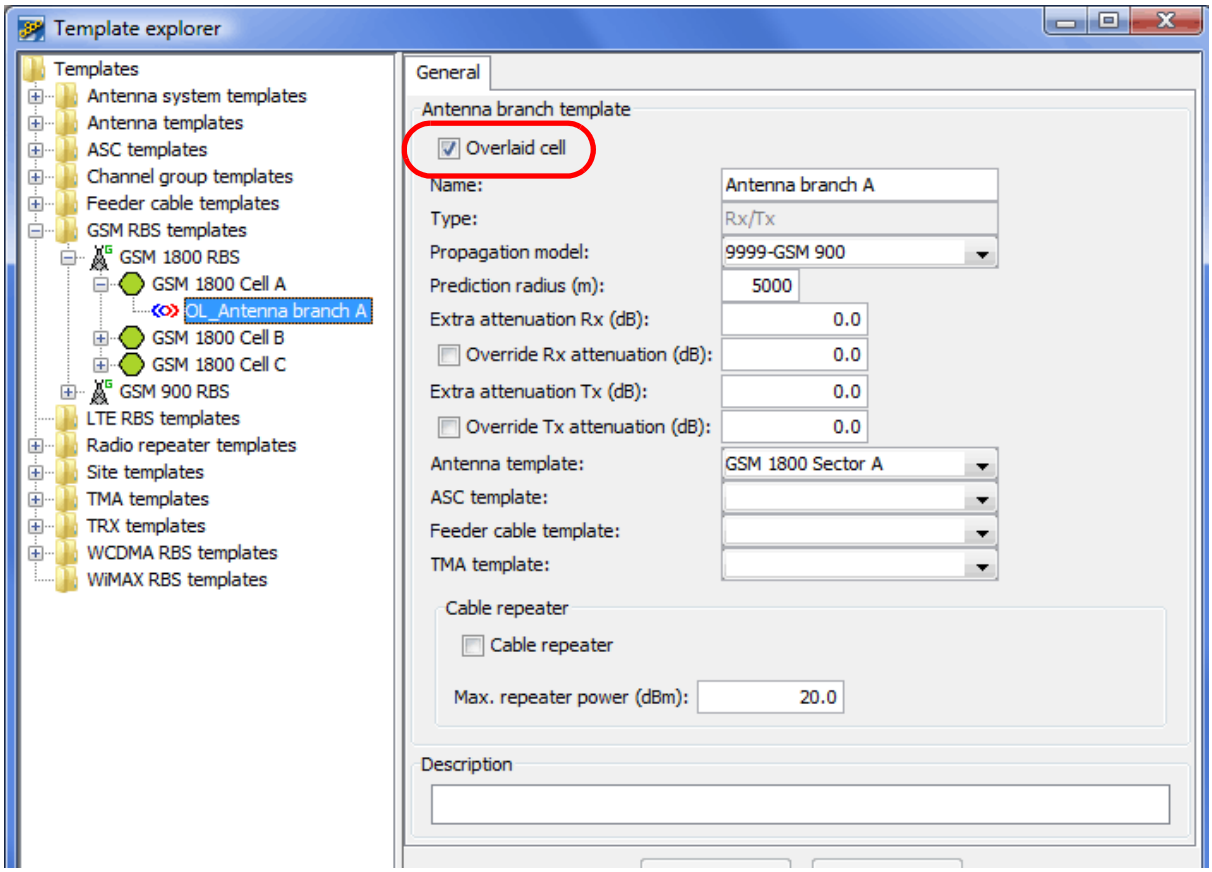
- See prerequisites of Define GSM Antenna Branch Template (Underlaid Sub-Cell) on page 8-15.
- Additionally, the overlaid sub-cell template must be defined, see Configure GSM Overlaid Sub-Cell Templates on page 8-13.

Procedure

To define an antenna branch template for overlaid sub-cells, follow these steps:

1. Select **Utilities↗Template explorer**, and locate the GSM cell template in the **GSM RBS template** folder.
2. In the cell template, ensure the following:
   - The option **Overlaid sub-cell template** is selected.
   - If the cell template defines a dual-band cell, ensure that the frequency band of the overlaid sub-cell template differs from the underlaid sub-cell, see Configure GSM Overlaid Sub-Cell Templates on page 8-13.
3. Right-click the GSM RBS cell, and select **Add Antenna branch template**.
4. Select in the following sequence of dialogs:
   - Antenna template. Select an antenna template supporting the frequency band of the overlaid sub-cell. If the same antenna shall be used in underlaid and overlaid sub-cells of different frequency bands (dual-band), the antenna type must support both frequency bands.
   - Antenna branch type
   - Propagation model. Select a propagation model applicable for the frequency band of the overlaid sub-cell.

5. When all dialogs are answered, the antenna branch is created under the GSM cell, and the **Antenna branch template** window appears.



6. Select the option **Overlaid cell.**

7. Change the other parameters as required. Ensure that the propagation model supports the frequency band of the overlaid sub-cell. See Fields on Window "Antenna branch template" for OL Cell on page 8-19.

8. Click **Apply** to preserve the antenna branch. The prefix of the antenna branch is changed from UL_ to OL_.

Fields on Window "Antenna branch template" for OL Cell

Overlaid cell	The antenna branch is valid for the overlaid cell. This option appears only for dual-band sub-cells, that is, with different frequency bands in overlaid and underlaid sub-cells. With this option enabled, applying the antenna branch template results in changing the prefix of the antenna branch to "OL_"
All other fields are the same as the fields of the underlaid cell antenna branch, see Fields on Window "Antenna branch template" on page 8-17.	

Site Related Templates

Site templates save you time when you have many sites using the same type of antenna systems, RBSs, radio repeaters and site attributes in your network plan.

Radio Repeater Templates

See *Define Radio Repeater Templates* in the *TEMS CellPlanner Common Features User's Guide*.

Site Templates

See *Define Site Templates* in the *TEMS CellPlanner Common Features User's Guide*.

9
GSM Sites, RBSs and Cells

This chapter describes how to define the sites with their network elements, GSM RBSs and GSM cells with antenna branches in a GSM network plan.

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Sites

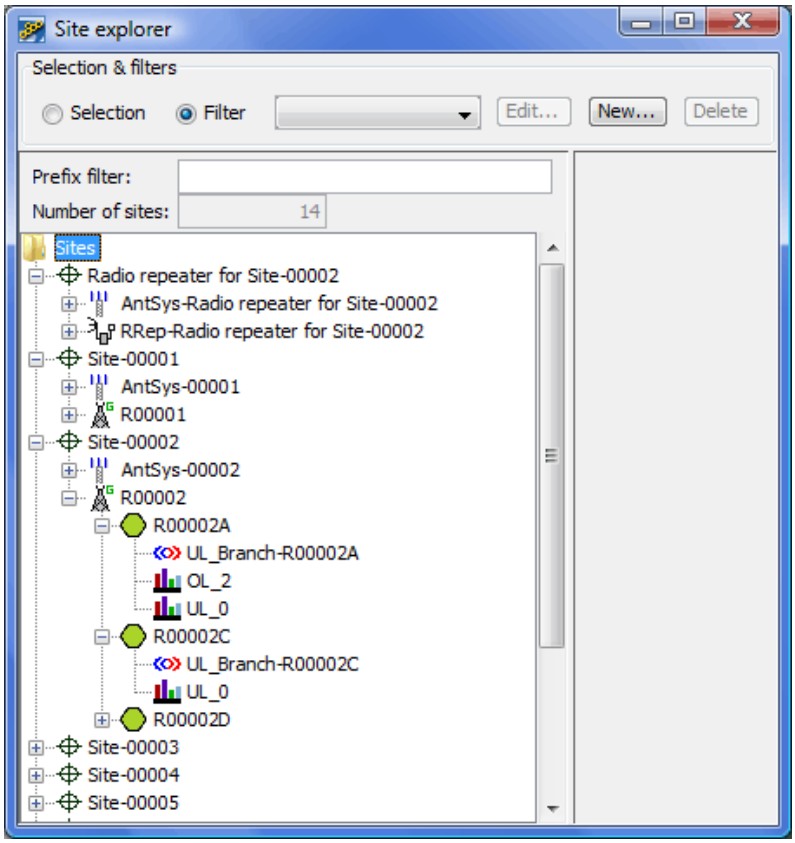
Before analyzing a network plan you shall add actual sites with their equipment and place them geographically in the network, using the **Site explorer**.

A GSM network may include

- GSM RBS sites with underlaid cells, optionally also with overlaid sub-cells
- multi-technology RBS sites (GSM RBS co-sited with RBS of other technology)
- radio repeater sites amplifying the radio signals of a donor cell

All sites must have an antenna system object including all site equipment.

A site configuration with five GSM RBS sites and a radio repeater is illustrated in the example below. The expanded RBS R00002 has three cells. Each cell has an antenna branch and a channel group for the cell. The initial channel group is named UL_0, where "UL" stands for "underlaid". Cell R00002A has an overlaid sub-cell, with its own channel group OL_0.



GSM RBSs with underlying network elements can also be managed from the **GSM RBS explorer**.

Read more about sites in chapter *Adding Sites and Determining Site Locations* in the *TEMS CellPlanner Common Features User's Guide*.

Add GSM Sites

Add sites by placing them geographically in your network planning area, and define their antenna heights.

See *Add Sites* in the *TEMS CellPlanner Common Features User's Guide*.

Antenna Systems

You add, modify and delete antenna systems using the **Site explorer**.

Add Antenna System to a Site (Create From Template)

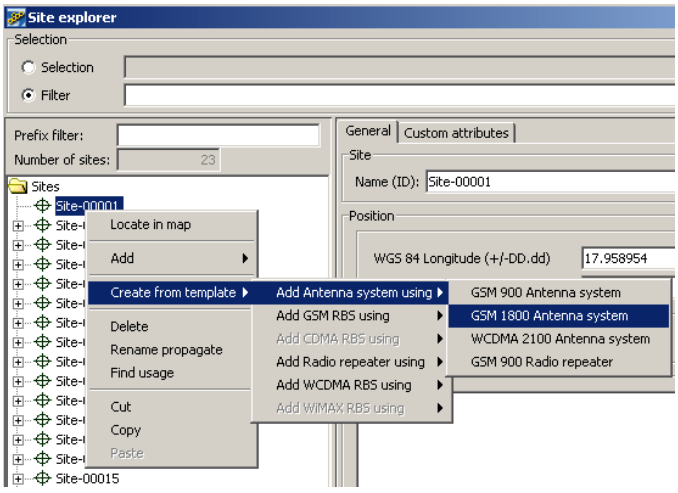
The most efficient way to add antenna related network elements (antennas, feeder cables, TMAs) to a site is to include those elements in an antenna system template and add an antenna system for the site by using this template.

Prerequisites

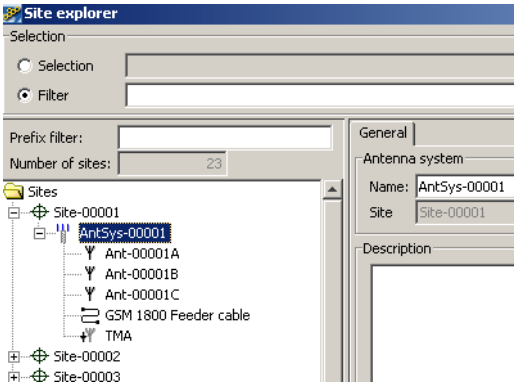
- The site to use the antenna system is added, see Add GSM Sites on page 9-3.
- The antenna system template is defined, see Antenna System Templates on page 8-5.

Procedure

1. **Select Utilities↗Site explorer**.
2. Locate the site in the browser, right-click on the site and select **Create from template↗Add Antenna system using↗**`<Antenna system template>`. In example below the template GSM 1800 Antenna system is selected for Site 00001:



3. All network elements defined for the antenna system template are created under the site. The result looks as in the following example:



Add Antenna System to a Site (Add Without Template)

Instead of using an antenna system template, an antenna system can be added in a more "raw" way to the site. You then add first the antenna system and subsequently all its network elements one by one.

Use this procedure to add an antenna system without using an antenna system template.

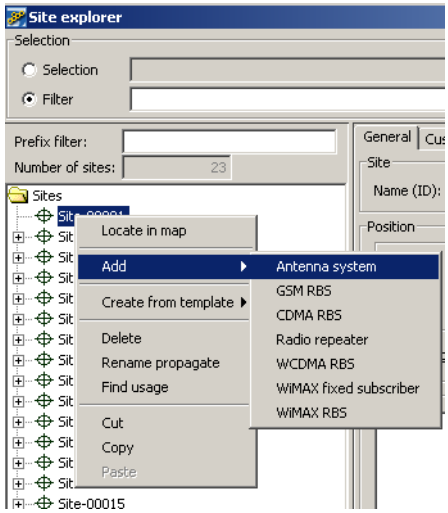
Prerequisites

The site to use the antenna system is added, see Add GSM Sites on page 9-3.

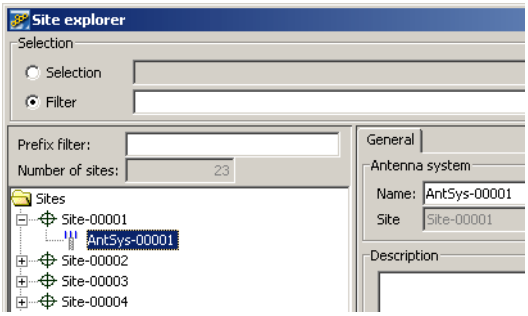
Procedures

1. Select **Utilities↗Site explorer**.

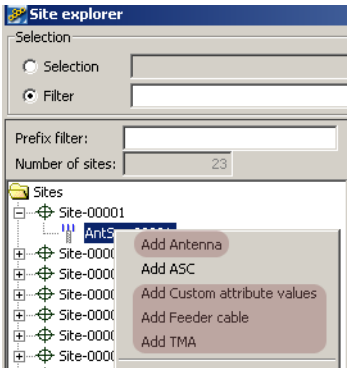
2. Locate the site in the browser, right-click on the site and select **Add↗ Antenna system**:



3. An empty antenna system network element is created under the site. The result looks as in the following example:



4. To fill the antenna system with information, you need to add network elements to the antenna system. Right-click on the antenna system and select the network element to add. The network elements relevant for GSM are highlighted in the figure below:



Note: *TMAs are part of GSM antenna systems, while ASCs are relevant for WCDMA antenna systems only.*

GSM RBSs and Cells

You can add, modify and delete GSM RBSs and cells using the **Site explorer** or the **GSM RBS explorer**.

About GSM Overlaid/Underlaid Sub-cells

A GSM cell can be an ordinary cell, or structured as an *overlaid/underlaid* cell.

The parameters of an underlaid sub-cell are configured using the procedure Configure General GSM Cell (or Underlaid Sub-Cell) Parameters on page 9-12.

The parameters of an overlaid sub-cell are configured using the procedure Configure GSM Cell Overlaid Sub-Cell Parameters on page 9-23.

A special case of overlaid/underlaid cells are the *multi-band* cells, with different frequency bands and propagation models in the underlaid and overlaid sub-cells. In practice these are *dual-band* cells, as there is one overlaid and one underlaid sub-cell per overlaid/underlaid cell pair. Dual-band UL and OL sub-cells have different propagation models as each propagation model uses a specific frequency band.

When you create a dual-band cell, you can connect the underlaid and overlaid antenna branches to different antennas or to the same dual-band antenna supporting both frequency bands. OL/UL sub-cells may also use the same frequency band, and are in that case using the same antenna.

Add GSM RBS to a Site (Create From Template)

The most efficient way to add a GSM RBS to a site is to first create a GSM RBS template and add the GSM RBS to the site, using this template. The cells and the antenna branches included in the GSM RBS template are added automatically.

The antenna system of the chosen system type is also automatically added to the site when adding the GSM RBS from a template, thus no antenna system need to be added to the site in advance.

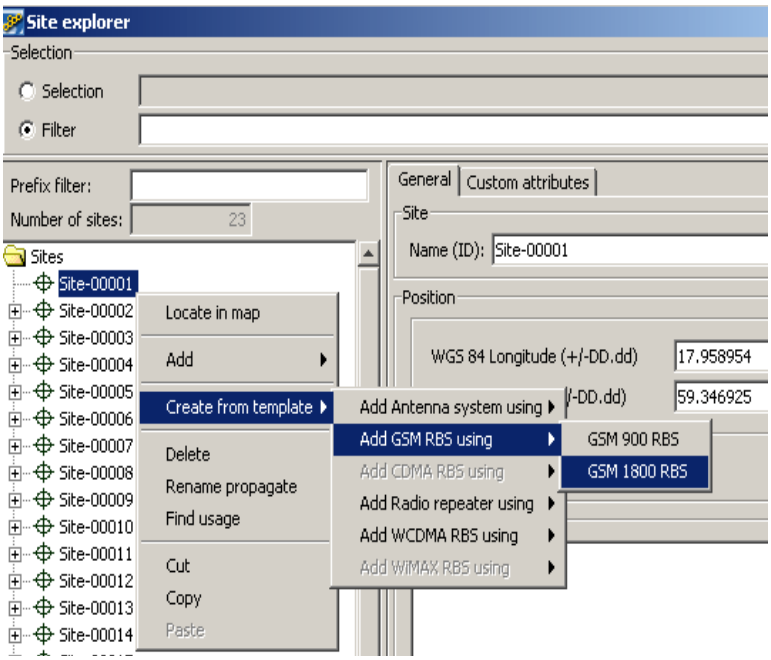
Prerequisites

- The site to use the GSM RBS is added, see Add GSM Sites on page 9-3.
- The GSM RBS template to use is defined, see Define GSM RBS Templates on page 8-9
- The antenna system template is defined, see Antenna System Templates on page 8-5.

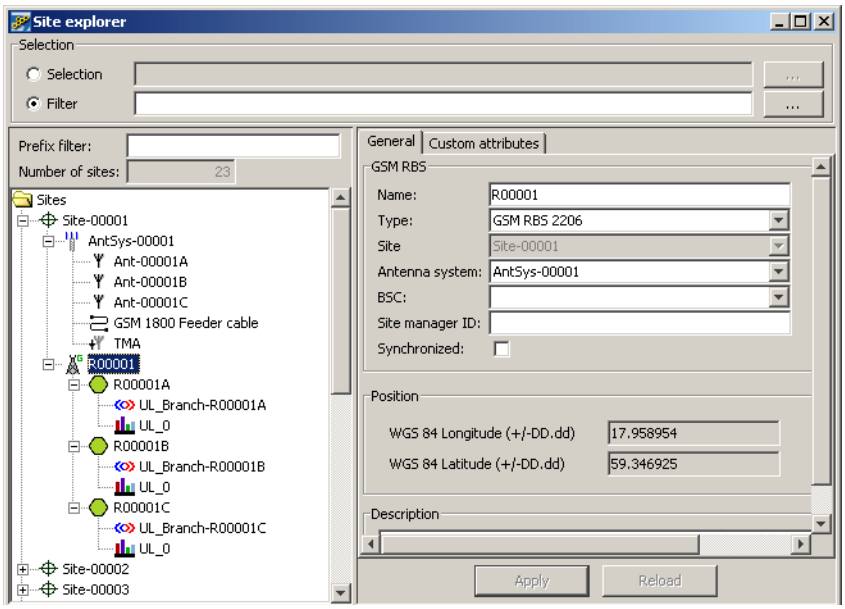
Procedure

1. Select **Utilities↗Site explorer**.

2. Locate the site in the browser, right-click on the site and select **Create from template↗Add GSM RBS using↗**<GSM RBS template>. In the example below template GSM 1800 RBS is selected for Site 00001:



3. All network elements defined for the GSM RBS template are created under the site. The result looks as in the following example:



4. If needed, change the parameters in the **GSM RBS** window and click **Apply** to preserve the settings.

Add GSM RBS to a Site (Add Without Template)

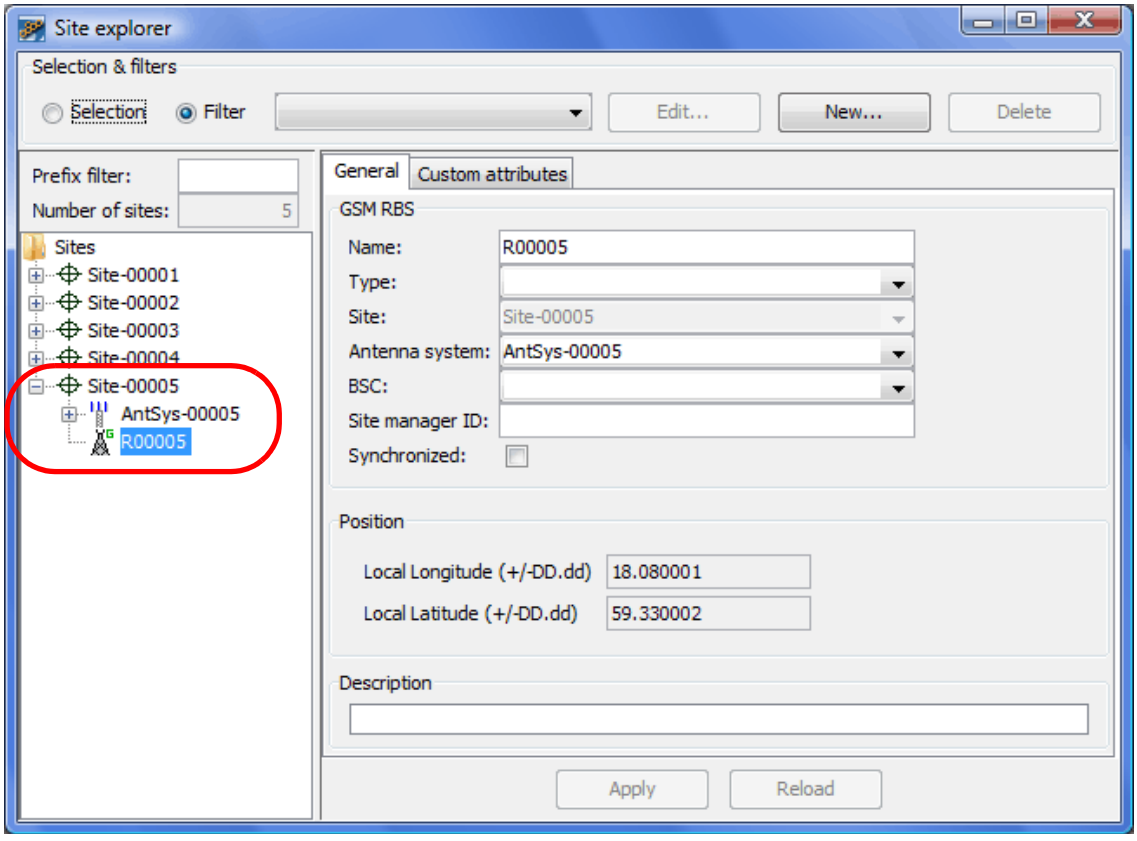
Instead of using GSM RBS template, a GSM RBS can be added in a more "raw" way to the site. You then add first the GSM RBS and subsequently all its network elements one by one.

Prerequisites

- The site of the GSM RBS is defined, see Add GSM Sites on page 9-3.
- The antenna system is defined, see Add Antenna System to a Site (Create From Template) on page 9-4.

Procedures

1. Select **Utilities↗Site explorer**.
2. Right-click on the site in the browser and select **Add↗GSM RBS**.
3. Select an antenna system for the GSM RBS in the displayed dialog window.
4. An RBS is created under the site, and the **GMS RBS** window appears:



5. Modify RBS parameters if needed and click **Apply** to preserve the settings.
6. Proceed with Add GSM Cell to an RBS on page 9-10.

Add GSM Cell to an RBS

You may add up to 3 (underlaid) cells and 3 overlaid sub-cells for each RBS. One channel group with default values is automatically added for each GSM (sub-)cell you add. An added cell requires an antenna branch as well.

See also Fields on Window "General - GSM Cell" on page 9-12.

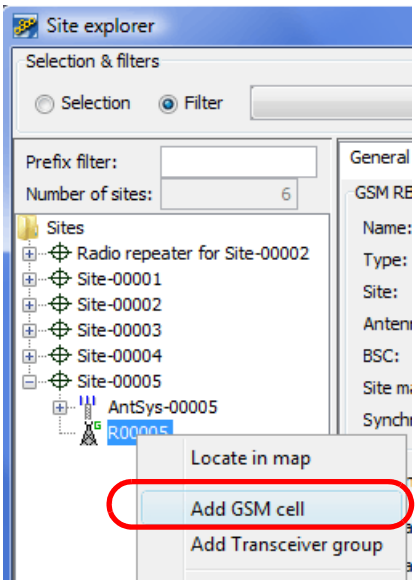
Prerequisites

- The RBS of the cell is defined, see Add GSM RBS to a Site (Add Without Template) on page 9-9.
- The frequency band to use is defined, see GSM Frequency Bands on page 6-5.

Procedure

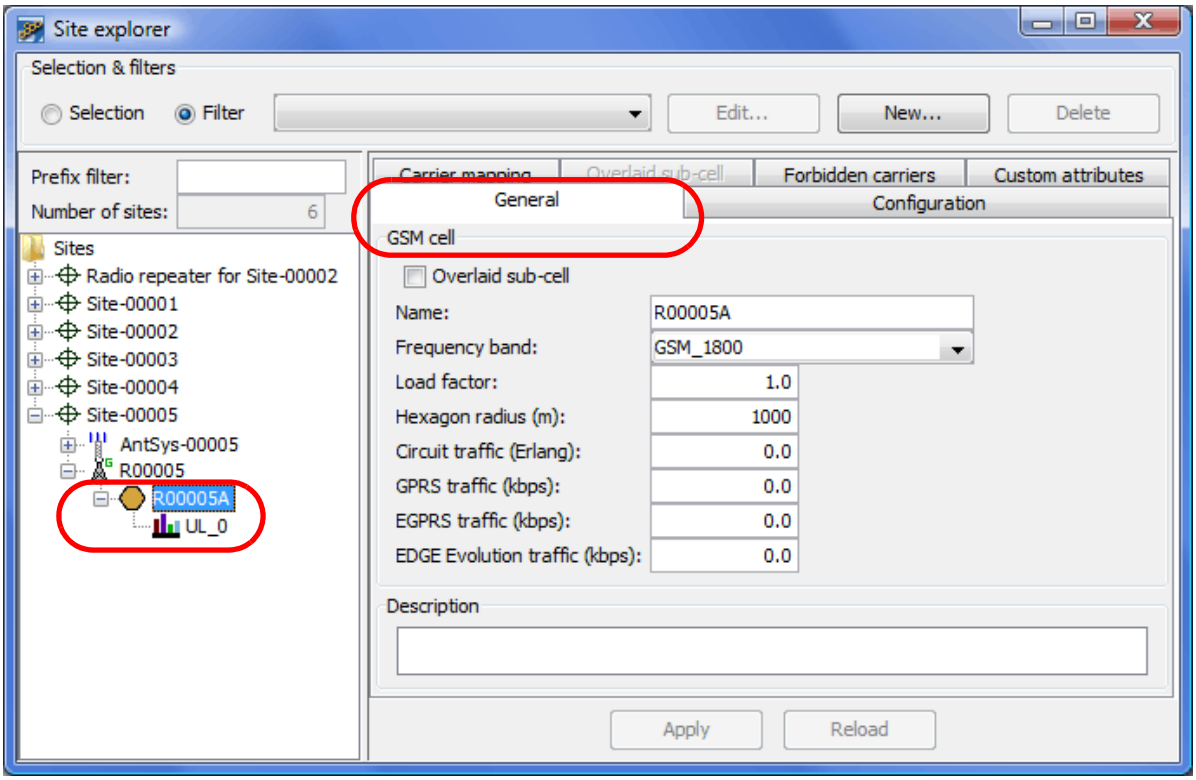
Follow these steps to add cells to GSM RBSs:

1. Select **Utilities↗Site explorer** (or **Utilities↗GSM RBS explorer**).
2. Right-click an RBS in the tree and select **Add GSM cell** from the menu.



3. Select a frequency band from the displayed dialog window.

4. A cell with an initial channel group `UL_0` is created and the **GSM cell** window appears as in the following example:



The initial channel group is always named `UL_0` as this is an underlaid (UL) cell. The name has initially no significance, but if you also create a overlaid sub-cell, this `UL_0` channel group will belong to the underlaid sub-cell.

After the GSM cell is created you shall configure all its parameters, as described in subsequent procedures, starting with Configure General GSM Cell (or Underlaid Sub-Cell) Parameters on page 9-12.

You must also add an antenna branch to the cell, see Add Antenna Branches to GSM Cells on page 9-33

You may also define an overlaid sub-cell with its own channel group, optionally with its own antenna branch, see Fields on Window "General - GSM Cell" on page 9-12.

Configure General GSM Cell (or Underlaid Sub-Cell) Parameters

Use this procedure to define general GSM cell parameters. If an overlaid sub-cell shall be created or is already defined, the settings in this procedure are for the underlaid sub-cell part of the GSM cell.

Prerequisites

The GSM cell is added to the RBS, see Add GSM Cell to an RBS on page 9-10.

Procedure

1. Select **Utilities↗Site explorer** or **Utilities↗GSM RBS explorer**.
2. Select the GSM cell to configure in the browser and open the **GSM cell** window under the **General** tab, see example in Add GSM Cell to an RBS on page 9-10.
3. Make sure the parameters have correct values, see Fields on Window "General - GSM Cell" on page 9-12.
4. If the cell shall have an overlaid sub-cell, follow the instructions in Create Overlaid Sub-Cell on page 9-21.
5. Click **Apply** to preserve the settings.

Fields on Window "General - GSM Cell"

Overlaid sub-cell	Selects the use of overlaid sub-cells.
Name	Name of the cell. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Frequency band	Frequency band to which the (sub-)cell is assigned. ***Note:*** *OL and UL sub-cells on the same frequency band share the same antenna branch(es). In the dual-band case, the underlaid (UL) and overlaid (OL) sub-cells have different frequency bands, and thus different antenna branches. The sub-cell of an antenna branch is selected in the Antenna branch window.*
Load factor	See Load Factor in Cells on page 15-13.
Hexagon radius (m)	Radius in meters of the cell hexagons
Circuit traffic (Erlang) **GPRS traffic (kbps)** **EGPRS traffic (kbps)** **EDGE Evolution traffic (kbps)**	Amount of traffic of the specified service type in the cell. Not input to traffic analysis, but may be overwritten by results from traffic analysis. Input to live traffic distribution, and may be overwritten by results from live traffic distribution.
Description	Description of the cell

Configure GSM Cell, Miscellaneous Info for Export and Analysis

Use this procedure to configure miscellaneous GSM cell parameters for the following purposes:

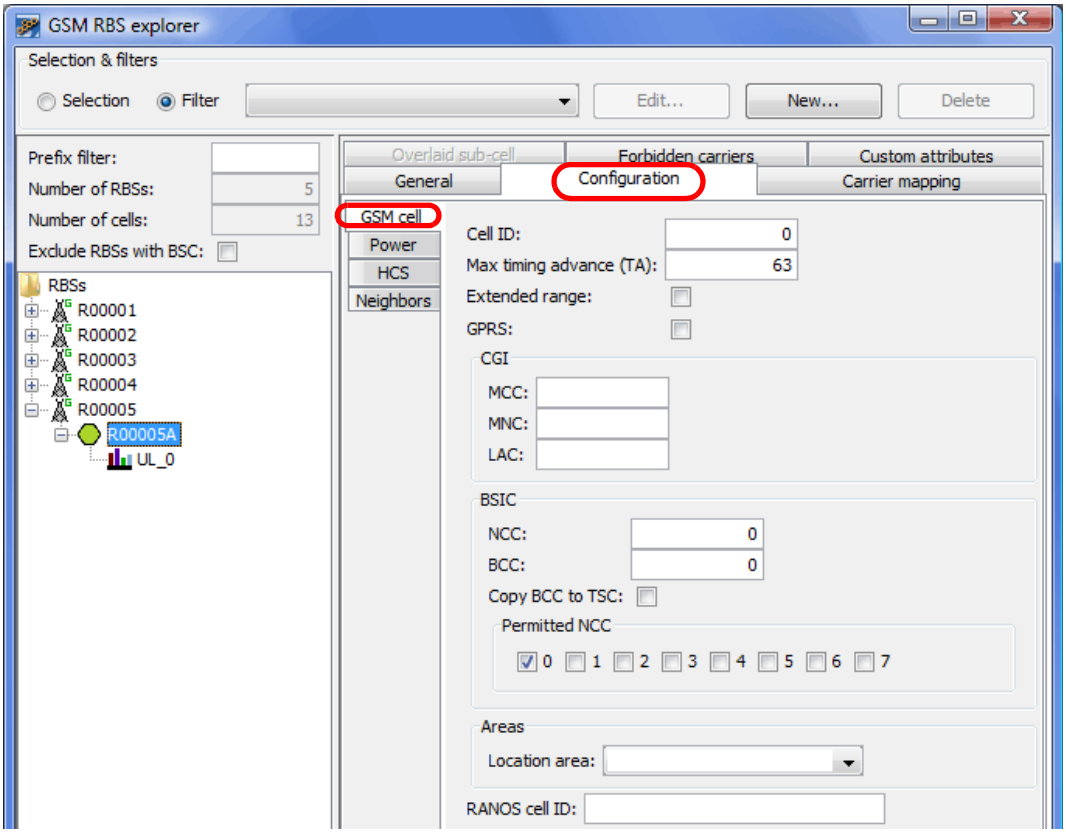
- Best Server Analysis (range information)
- Traffic Performance Analysis (GPRS capability information)
- Export GSM cell data for import by an Ericsson OSS-RC, see Import and Export of GSM Carriers on page 13-2
- Export cell data in text format to be imported by some other GSM O&M system, see *Export Cells text file* in *TEMS CellPlanner Common Features User's Guide*

Prerequisites

The GSM cell is added to the RBS, see Add GSM Cell to an RBS on page 9-10.

Procedure

1. Select **Utilities↗GSM RBS explorer** (or **Utilities↗Site explorer**).
2. Select the GSM cell in the browser and select the **Configuration** tab.
3. Select the **GSM cell** sub-tab.



4. Assign the parameters. The MCC and MNC are given by the Subnetwork. The LAC will be assigned when you select a Location area. The TSC may be assigned only if an overlaid sub-cell exists.
5. Click **Apply** to preserve the settings.

Fields on Window "Configuration - GSM cell"

Some of these parameters are imported from / exported to OSS-RC CNAI file, see the *TEMS CellPlanner Common Features Technical Reference Manual*.

Cell ID	Identifier of the cell in TEMS CellPlanner
Max timing advance (bit time)	Maximum allowed timing advance in bit periods. Limits the radius of the best server area. Used in Best Server Analysis. Range: 0 - 219. Default = 63
Extended range	Allows maximum timing advance to exceed 63.
GPRS	Indicates if the cell is GPRS capable. Input to Traffic Performance Analysis.
CGI	
MCC	Mobile Country Code (MCC) of the Cell Global Identity (CGI) given by the subnetwork
MNC	Mobile Network Code (MNC) of the Cell Global Identity (CGI) given by the subnetwork
LAC	Location Area Code (LAC) of the Cell Global Identity (CGI) given by the location area
BSIC	
NCC	Network color code (NCC) of the Base Station Identity Code (BSIC) for the cell. Range: 0 - 7.
BCC	Base station Color Code (BCC) of the Base Station Identity Code (BSIC) for the cell. Range: 0 - 7.
Copy BCC to TSC	Initially disabled option to copy BCC to all Training Sequence Codes (TSCs) in the channel group.
Permitted NCC	Number of the permitted Network Color Code
Location area	Selects one of the location areas in the subnetwork
RANOS cell id	Identity of the cell in the RANOS system

Configure GSM Cell Power Settings for Export

Use this procedure to configure GSM cell power information, required only for the following purposes:

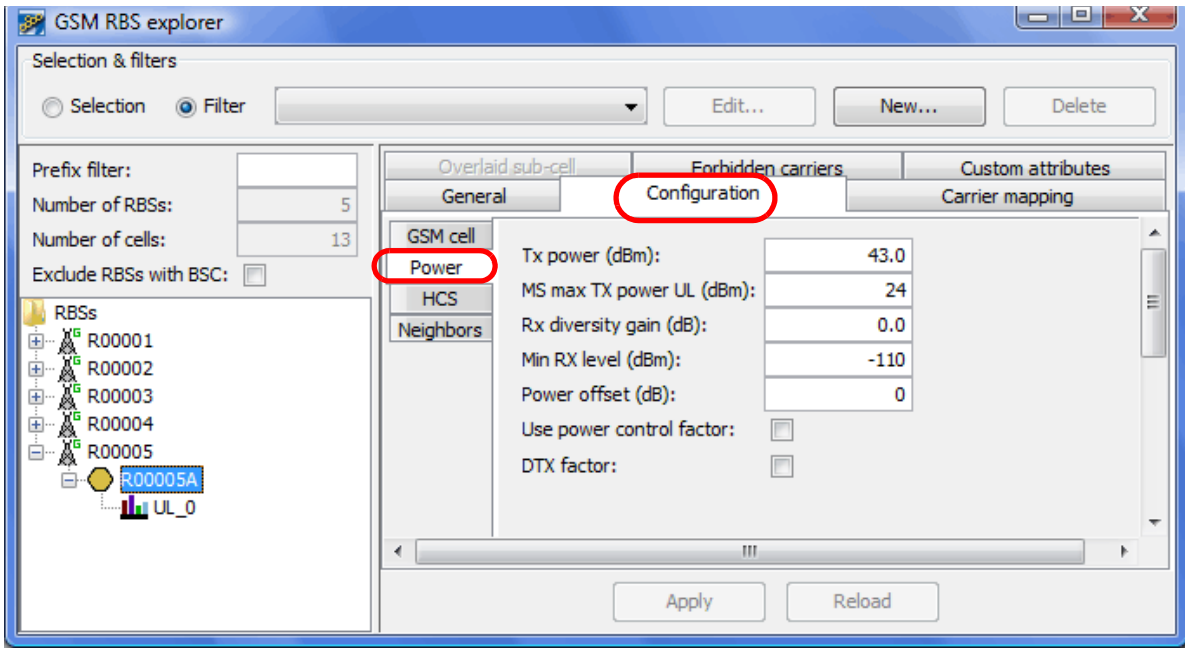
- Export GSM cell data for import by an Ericsson OSS-RC, see Import and Export of GSM Carriers on page 13-2
- Export cell data in text format to be imported by some other GSM O&M system, see *Export Cells text file* in *TEMS CellPlanner Common Features User's Guide*

Prerequisites

The GSM cell is added to the RBS, see Add GSM Cell to an RBS on page 9-10.

Procedure

1. Select **Utilities↗GSM RBS explorer** (or **Utilities↗Site explorer**).
2. Locate the GSM cell in the tree and select it.
3. Select the **Configuration** tab.
4. Select the **Power** sub-tab.



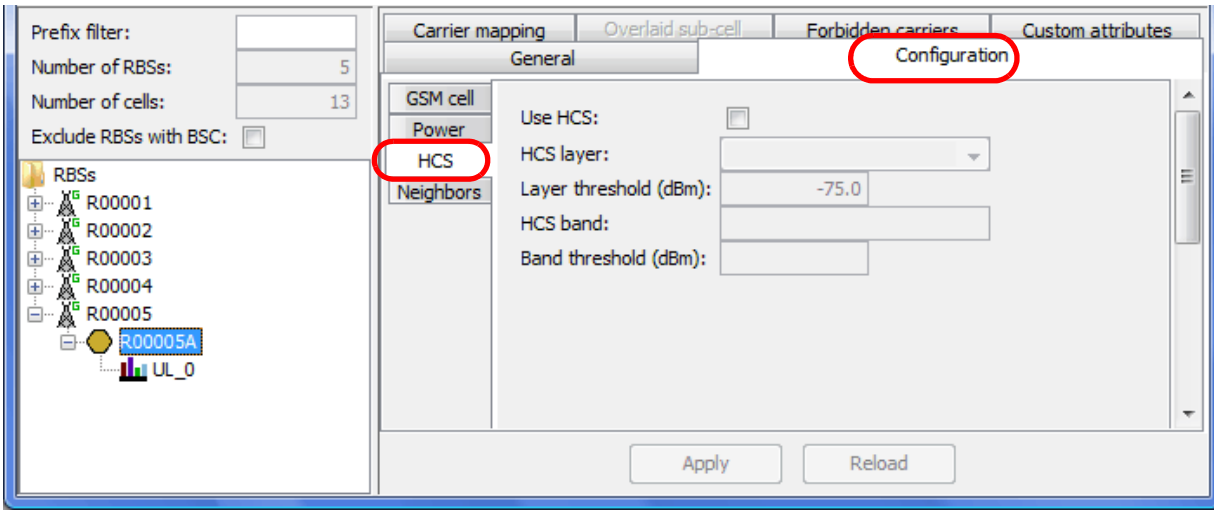
5. Set the power parameters as desired, see Fields on Window "Configuration - GSM cell" on page 9-14.
6. Click **Apply** to preserve the settings.

Fields on Window “Configuration - Power”

MS max. TX power UL (dBm)	The mobile station maximum transmission power in dBm for the uplink
Rx diversity gain (dB)	Gain in dB added to the received signal due to spatial antenna diversity
Min RX level (dBm)	Ericsson-specific minimum received GSM level in dBm
Power offset (dB)	Power offset in dB of the cell. Not used for any calculations. Mapped to `SSOFFSETDL` at Import and Export of GSM Carriers. Range: -30 to 30.Initial value = 0 dB.
Use power control factor	Indicates that the cell uses downlink power control. The interference is then reduced by the power control factor, defined in Configure GSM Project Parameters on page 4-4. Affects Interference Analysis.
DTX factor	Indicates that the cell uses downlink discontinuous transmission (DTX). The interference is then reduced by the DTX factor, defined in Configure GSM Project Parameters on page 4-4. Affects Interference Analysis.

Configure GSM Cell HCS Settings

The parameters in the **HCS** sub-tab under the **Configuration** tab are described in Configure HCS Parameters of a GSM Cell on page 11-5.



Add GSM Cell Neighbor Relations for Export

Use this window to add neighbor information to a GSM cell. The relations are relevant only for the following purposes:

- Export GSM cell data for import by an Ericsson OSS-RC, see Import and Export of GSM Carriers on page 13-2
- Export cell data in text format to be imported by some other GSM O&M system, see *Export Cells text file* in *TEMS CellPlanner Common Features User's Guide*

Chapter Neighbors in the *TEMS CellPlanner Common Features User's Guide* contains a more up-to-date description on how you can add, modify and delete neighbors. The descriptions below will be aligned in a later release.

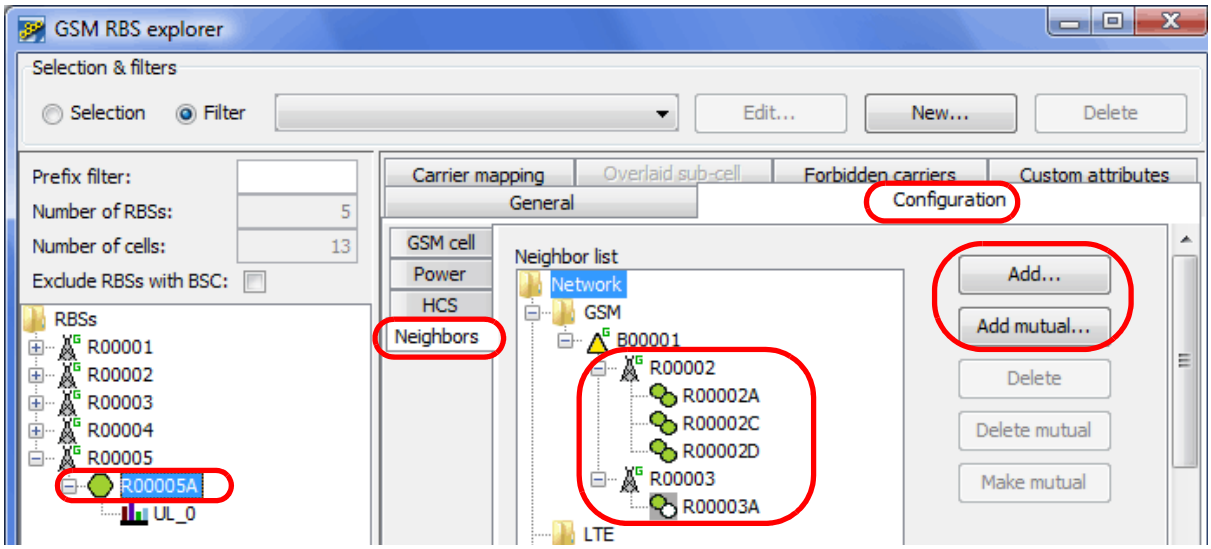
Prerequisites

The GSM cell is added to the RBS, see Add GSM Cell to an RBS on page 9-10.

Procedure

1. Select **Utilities↗Site explorer** or **Utilities↗GSM RBS explorer**.
2. Select the GSM cell for which neighbor relations shall be added.
3. Select the Configuration tab and the Neighbors sub-tab. The Neighbor list window appears.
4. To create *non-mutual* cell relations, click Add. The Cell selection (Add) window appears. Select cell(s) from the appropriate technology and apply the selection by clicking OK. The added cells appear in the Neighbor list.
5. To create *mutual* cell relations, click Add. The Cell selection (Add mutual) window appears. Select cell(s) from the appropriate technology and apply the selection by clicking OK. The added cells appear in the Neighbor list.

6. Click **Apply** to preserve the settings. The figure below shows an example neighbor list, where cell R00005A has mutual relations to all cells of RBS R00002, and one non-mutual relation to cell R00003A.



Fields on Window "GSM cell - Configuration - Neighbors"

(Neighbor list)	Shows the neighbors for a cell, organized by technology and then by RBS. Mutual cell relationships are displayed with a double green cell icon. Non-mutual relationships are displayed with a green/white cell icon.
Add...	Displays the **Cell selection (Add)** window for adding neighbor cells to the highlighted cell. Using this button, the cell relationship is non-mutual.
Add mutual...	Displays the **Cell selection (Add mutual)** window for adding a mutual cell neighbor relationship.
Delete	Deletes a neighbor relationship from a cell
Delete mutual	Deletes a mutual relationship from the original cell and its neighbor
Make mutual	Makes a cell relationship mutual between two cells

Select GSM Cell Carrier Mappings

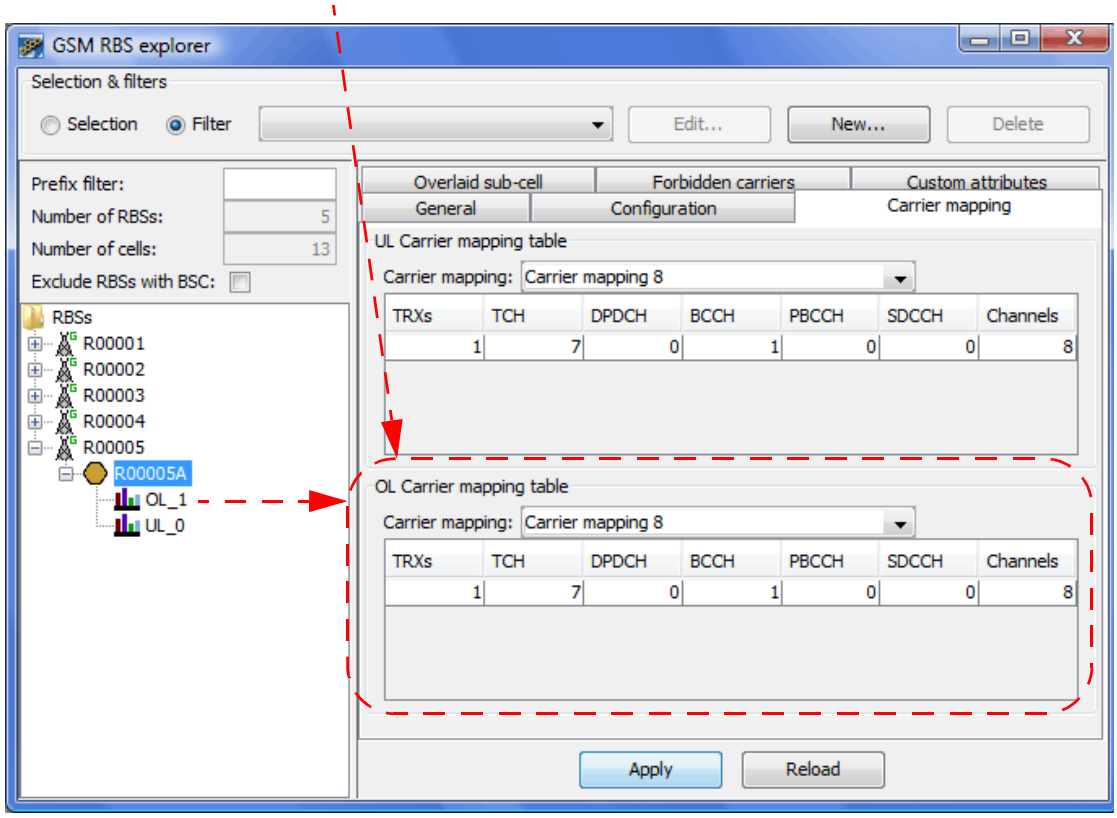
Use this procedure to select carrier mappings for a GSM cell.

Prerequisites

- The GSM cell is added to the RBS, see Add GSM Cell to an RBS on page 9-10.
- Carrier mappings are defined, see Define GSM Carrier Mappings on page 6-3.

Procedure

1. Select **Utilities↗GSM RBS explorer** (or **Utilities↗Site explorer**).
2. Locate and select the GSM cell in the browser to the left.
3. Select the **Carrier mapping** tab. The **UL carrier mapping table** appears. If the **Overlaid sub-cell option** is selected in the **General** tab, the **OL carrier mapping table** appears as well.



4. Select a carrier mapping from the **UL carrier mapping table** and (if displayed) a carrier mapping from the **OL carrier mapping table**.
5. Click **Apply** to preserve the settings.

Select GSM Cell Forbidden Carriers

When you are planning cells close to a country border, some frequencies may be banned since they are allocated for use in the other country. To prevent the Automatic Frequency Planning (AFP) from using those frequencies, you need to select those as *forbidden carriers*.

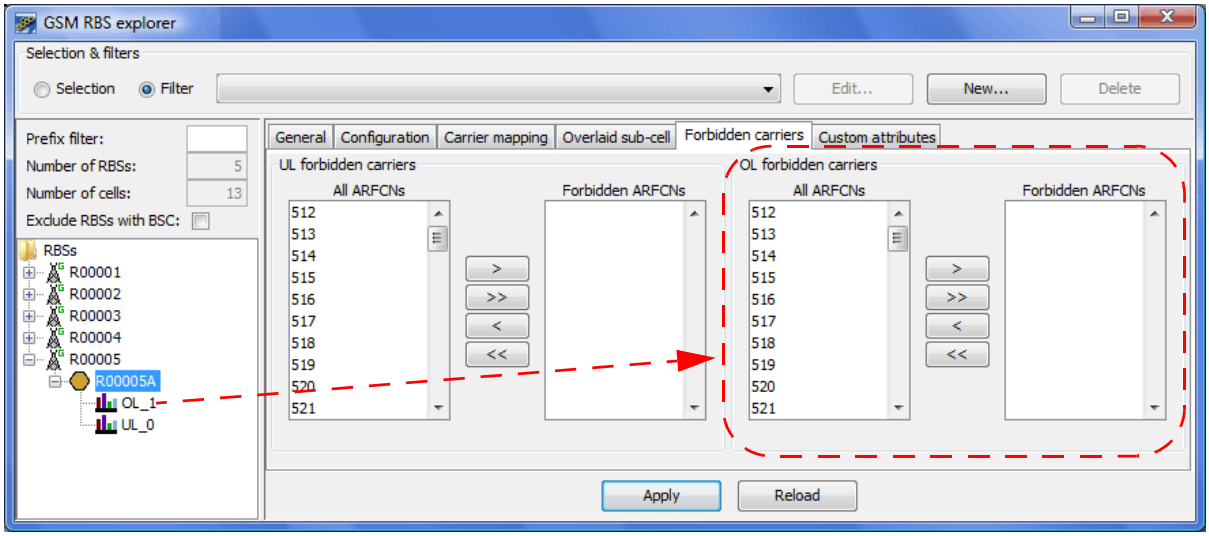
Prerequisites

The GSM cell is added to the RBS, see Add GSM Cell to an RBS on page 9-10.

Procedure

1. Select **Utilities↗Site explorer** or **Utilities↗GSM RBS explorer**.
2. Locate the GSM cell in the tree and select it.
3. Select the **Forbidden carriers** tab. A pane with **UL forbidden carriers** appears. If overlaid sub-cell is defined, a pane with **OL forbidden carriers** appears as well.

The lists of forbidden OL carriers is present only if OL sub-cell (and OL channel group) defined



4. Use the arrows to move carrier numbers from the list of **All ARFCNs** to the **Forbidden ARFCNs** list, and vice versa.
5. Click **Apply** to preserve the settings.

Create Overlaid Sub-Cell

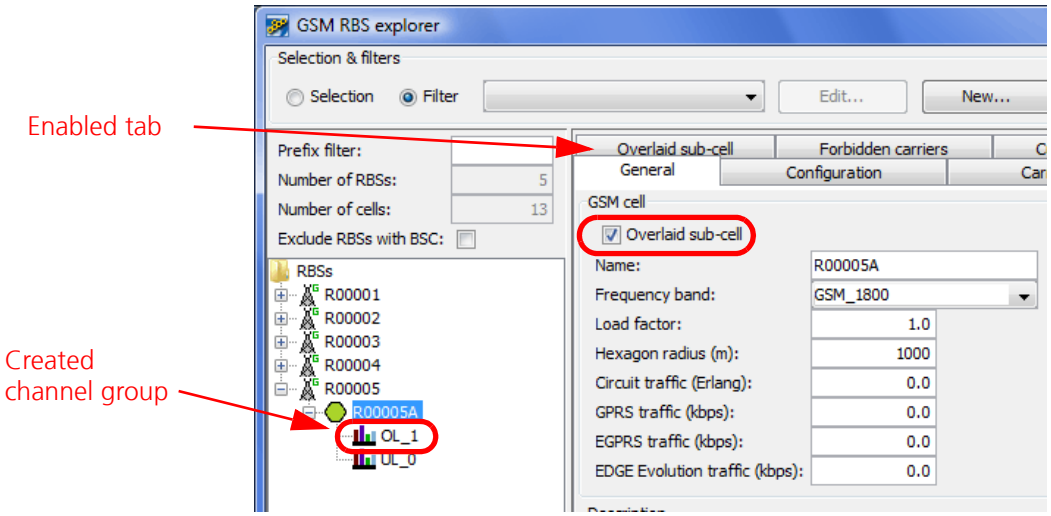
Use this procedure to create an overlaid (OL) sub-cell with its own channel group. The OL sub-cell is an addition to an already existing GSM cell, which configuration then becomes the configuration of the underlaid (UL) sub-cell.

Prerequisites

The GSM cell is added to the RBS, see Add GSM Cell to an RBS on page 9-10.

Procedure

1. Select **Utilities↗Site explorer** or **Utilities↗GSM RBS explorer**.
2. Select the GSM cell for which an overlaid sub-cell shall be created and select the **General** tab to open the **GSM cell** window.
3. Select the **Overlaid sub-cell** option. The **Overlaid sub-cell** tab becomes enabled.
4. Click **Apply** to preserve the settings. A channel group `OL_1` for the overlaid sub-cell is created under the cell and the **Overlaid sub-cell** tab becomes enabled.



The UL and OL sub-cells belong to the same GSM cell, hence no new GSM cell object is created for an OL sub-cell. The channel groups are numbered as UL_x or OL_x, where x is a sequence number assigned according to the order of creation.

Note: *The window under the General tab shows the parameters of the underlaid sub-cell. Use procedure* Configure GSM Cell Overlaid Sub-Cell Parameters *on page 9-23* *to set the overlaid sub-cell parameters.*

The OL sub-cell must have an antenna branch to be complete. If the same frequency band is used as for the UL sub-cell, the OL/UL sub-cells will share antenna branch.

If different frequency bands are used, the OL sub-cell must have its own antenna branch, see Add Antenna Branches to GSM Cells on page 9-33.

Configure GSM Cell Overlaid Sub-Cell Parameters

Use this procedure to define overlaid sub-cell information of a GSM cell. For more information on this topic, see About GSM Overlaid/Underlaid Sub-cells on page 9-7.

TEMS CellPlanner allows overlaid/underlaid subcells to be defined in any cell. When a cell is divided into an overlaid and an underlaid subcell, all data previously defined for the cell is applied to the underlaid subcell. Additional parameters can be defined for overlaid subcells:

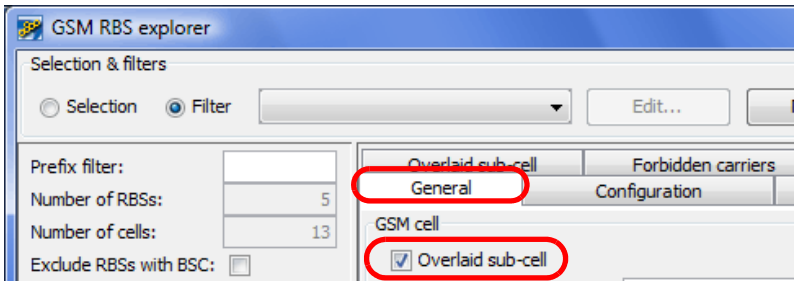
- Max timing advance
- Max pathloss threshold
- Tx power
- Training Sequence Code (TSC)

The maximum timing advance and the maximum allowed pathloss for the overlaid subcell should be set smaller than for the underlaid subcell.

The calculation of best server and traffic performance assume that mobile stations within the overlaid subcell service area are served by the overlaid subcell. Only when the overlaid subcell is fully loaded are the mobile stations within its service area instead served by the underlaid subcell.

Prerequisites

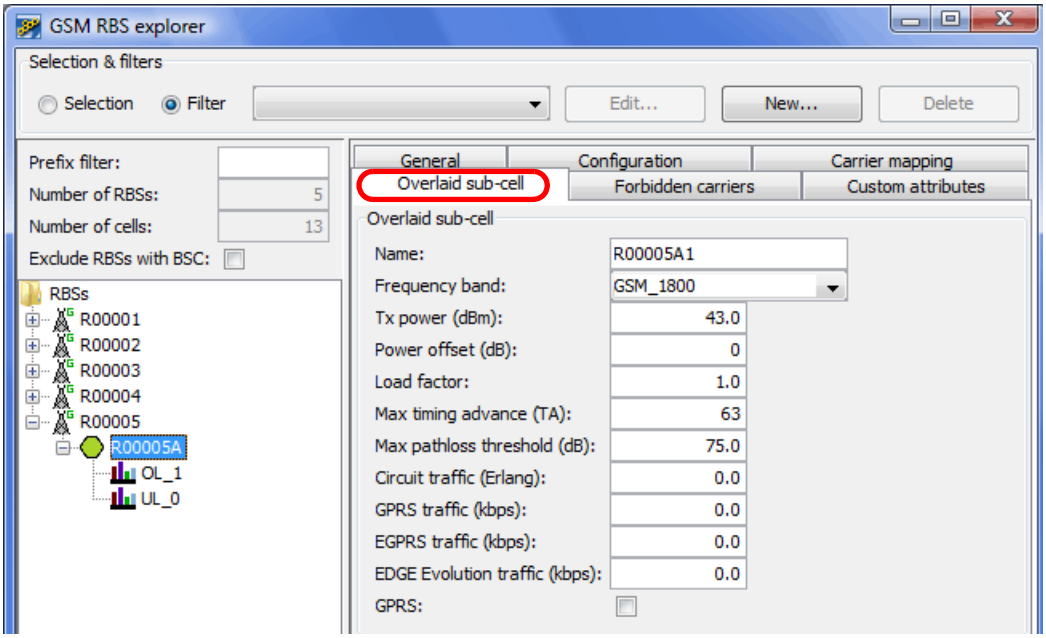
- The GSM cell is added to the RBS, see Add GSM Cell to an RBS on page 9-10.
- The frequency band to use in the overlaid sub-cell is defined, see GSM Frequency Bands on page 6-5.
- The option **Overlaid sub-cell** on the **GSM RBS Cell - General** window is selected. This enables the **Overlaid sub-cell** tab, as in the following picture:



Procedure

1. Select **Utilities↗GSM RBS explorer** (or **Utilities↗Site explorer**).
2. Locate the GSM cell in the browser and select it.

3. Select the **Overlaid sub-cell** tab.



4. Select a frequency band for the overlaid sub-cell from the list.
5. Assign the other parameters as desired, see Fields on Window "Overlaid sub-cell" on page 9-24
6. Click **Apply** to preserve the settings.

The OL sub-cell must have an antenna branch to be complete. If the same frequency band is used as for the UL sub-cell, the OL/UL sub-cells will share antenna branch. If different frequency bands are used, the OL sub-cell must have its own antenna branch, see Add Antenna Branches to GSM Cells on page 9-33.

Fields on Window "Overlaid sub-cell"

The marked parameters are further described in the *TEMS CellPlanner GSM Technical Reference Manual*.

Name	Name of the overlaid sub-cell. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Frequency band	Frequency band of the overlaid sub-cell
Tx power (dBm)	TCH frequency output power. Range: 0 - 80. Initial value = 43 dBm.
Power offset (dB)	Power offset in dB of the overlaid sub-cell. Not used for any calculations. Mapped to `SSOFFSETDL` at Import and Export of GSM Carriers.

Load factor	Traffic load factor for the overlaid sub-cell. Can be set manually or by Traffic Performance Analysis. Used for Interference Analysis. Range: 0 - 1. Default: 1.
Max timing advance (TA)	Maximum allowed timing advance in bit periods allowed for the overlaid sub-cell. Range: 0 - 219. Default = 63.
Max pathloss threshold (dB)	Maximum pathloss threshold in dB allowed for the overlaid sub-cell.
Circuit traffic (Erlang) **GPRS traffic (kbps)** **EGPRS traffic (kbps)** **EDGE Evolution traffic (kbps)**	Amount of traffic of the specified service type in the cell. Not input to traffic analysis, but may be overwritten by results from traffic analysis. Input to live traffic distribution, and may be overwritten by results from live traffic distribution.
GPRS	Indicates if the overlaid sub-cell has GPRS capabilities. Initially unselected.
Description	Description of the overlaid sub-cell

Define Channel Group for GSM Cells

Use this procedure to allocate a number of TRXs to the GSM cell, to map channels (BCCH or TCH) to the TRXs and to assign frequency groups from pre-defined frequency group sets to the TRX. If using hopping (no fixed frequencies), you can also use this procedure to define HSN and MAIO numbers for frequency planning.

A *channel group* is a network element under a GSM cell in the Site and GSM RBS explorers.

Overlaid and underlaid sub-cells have different channel groups. By default, underlaid sub-cells have one BCCH TRX allocated in their channel groups, and overlaid sub-cells have one TCH TRX allocated in their channel groups.

For cells with fixed or baseband hopping frequencies, only one channel group per sub-cell is needed.

A cell (or underlaid sub-cell) with synthesizer hopping frequencies can be planned with one or two channel groups. In the first case, all TRXs are hopping on all time slots, except for the BCCH and possibly the SDCCH time slots, which use a fixed frequency. In the second case, the first channel group (UL_0) shall contain one fixed frequency for the BCCH TRX, while the second channel group (UL_x, where x is the next sequence number of defined UL channel groups) shall be synthesizer hopping.

The hop type of the TRXs in this procedure must match the hop type of the frequency set, see Define Frequency Group Sets on page 6-10, to be selectable for the TRX.

Prerequisites

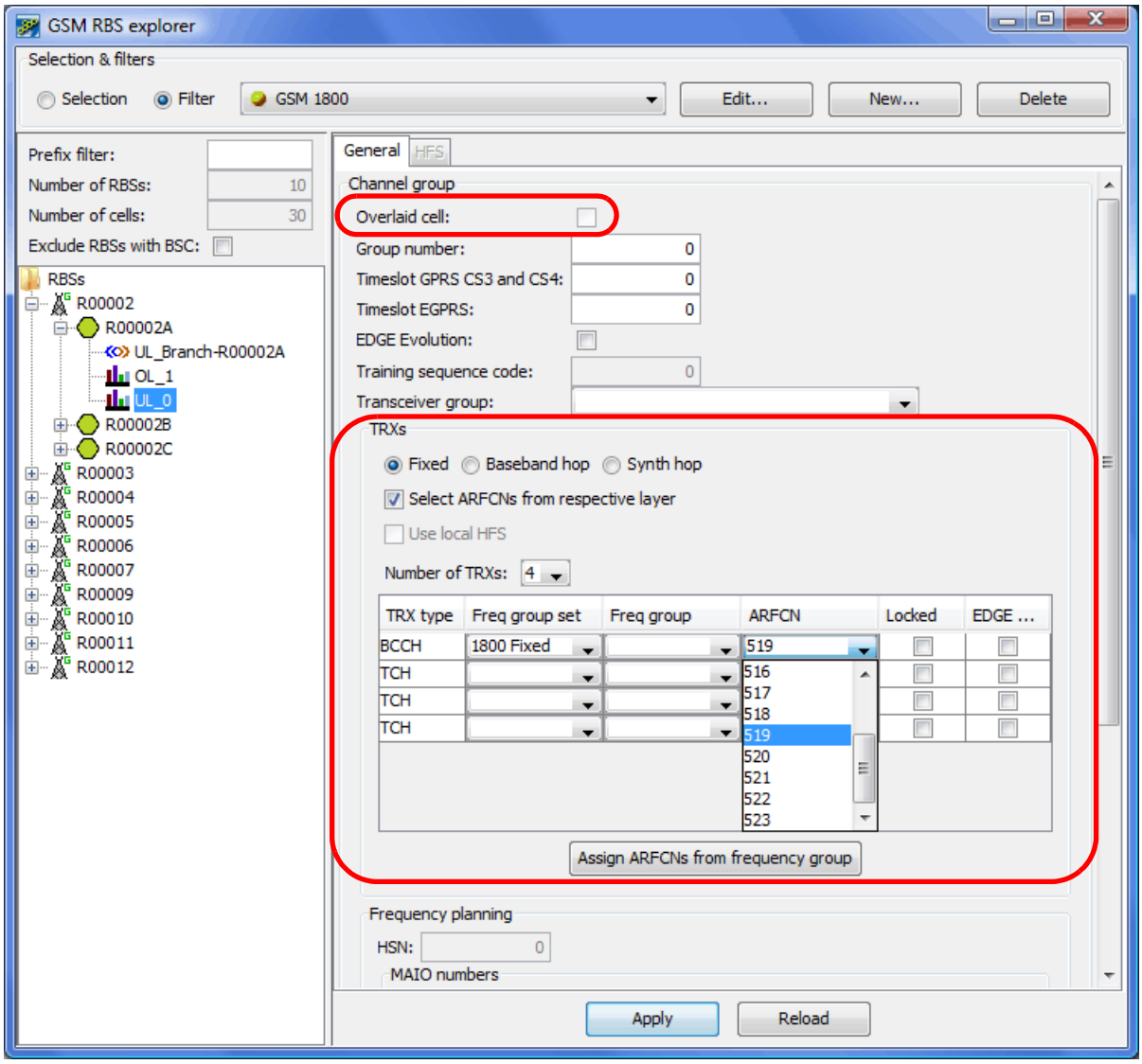
- The GSM cell is added to the RBS, see Add GSM Cell to an RBS on page 9-10.
- If frequency groups shall be used for frequency planning of the cell, they must be defined for the appropriated frequency band and hopping type, see Define Frequency Group Sets on page 6-10.

Procedure

Follow these steps to define channel group information:

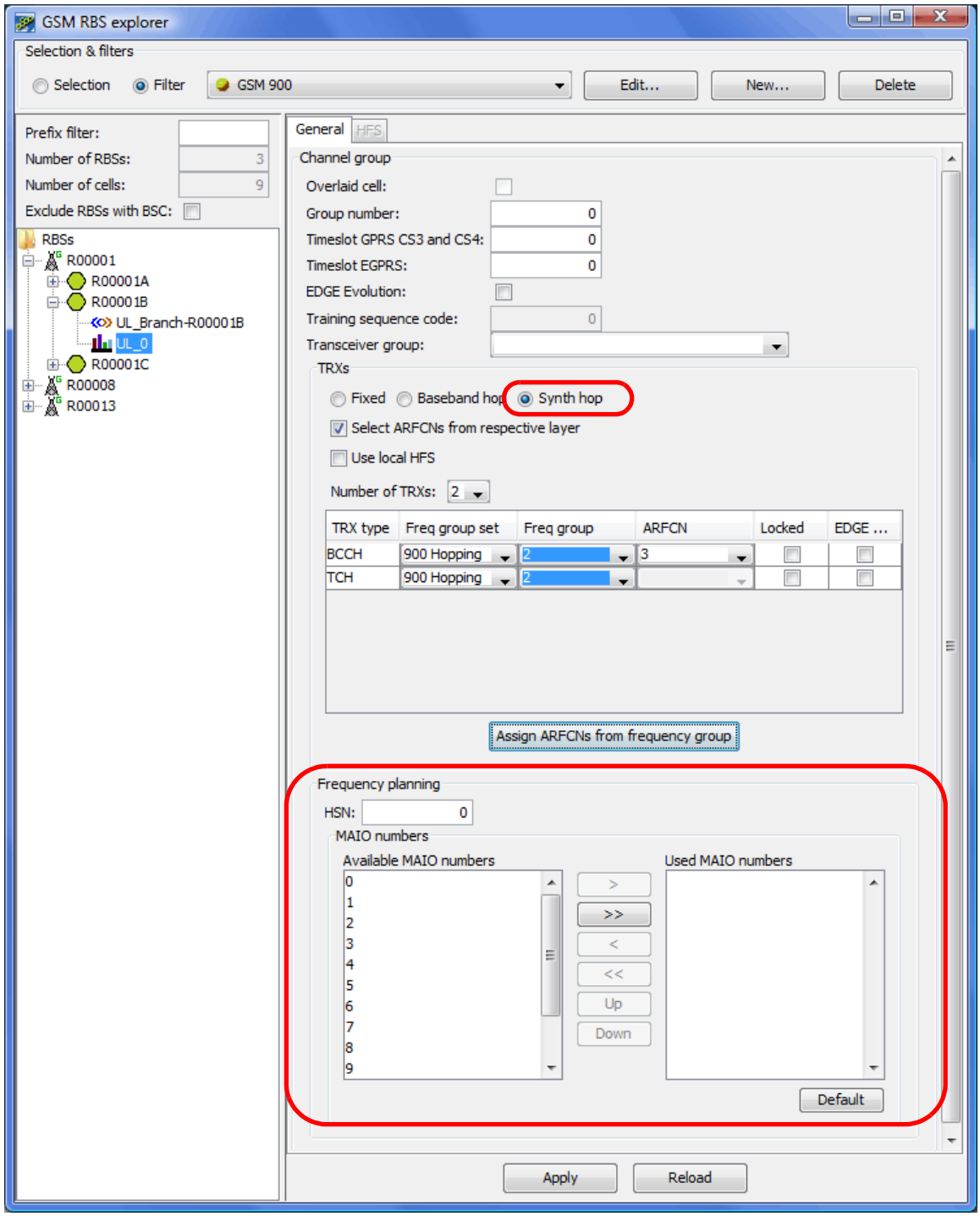
1. Select **Utilities↗GSM RBS explore**r or **Utilities↗Site explorer**.
2. Right-click the cell to which you want to add channel groups and select **Add channel group**. The **Channel group** window appears, as in the example below.
3. If the cell contains an overlaid sub-cell, indicate whether the Channel group belongs to the underlaid or overlaid sub-cell by selecting or clearing the **OLCell** option. The channel group belongs by default to the underlaid sub-cell.
4. Select hopping type: **Fixed**, **Baseband hop**, or **Synth hop**.
5. If you want to perform a Manually Optimized Frequency Planning including this channel group, select a **Frequency group set**, a **Frequency group**, and assign a frequency (**ARFCN**) to the TRX. Only the frequency group sets configured for

the same frequency band as in the filter, and for the same hopping type, appear as selectable.

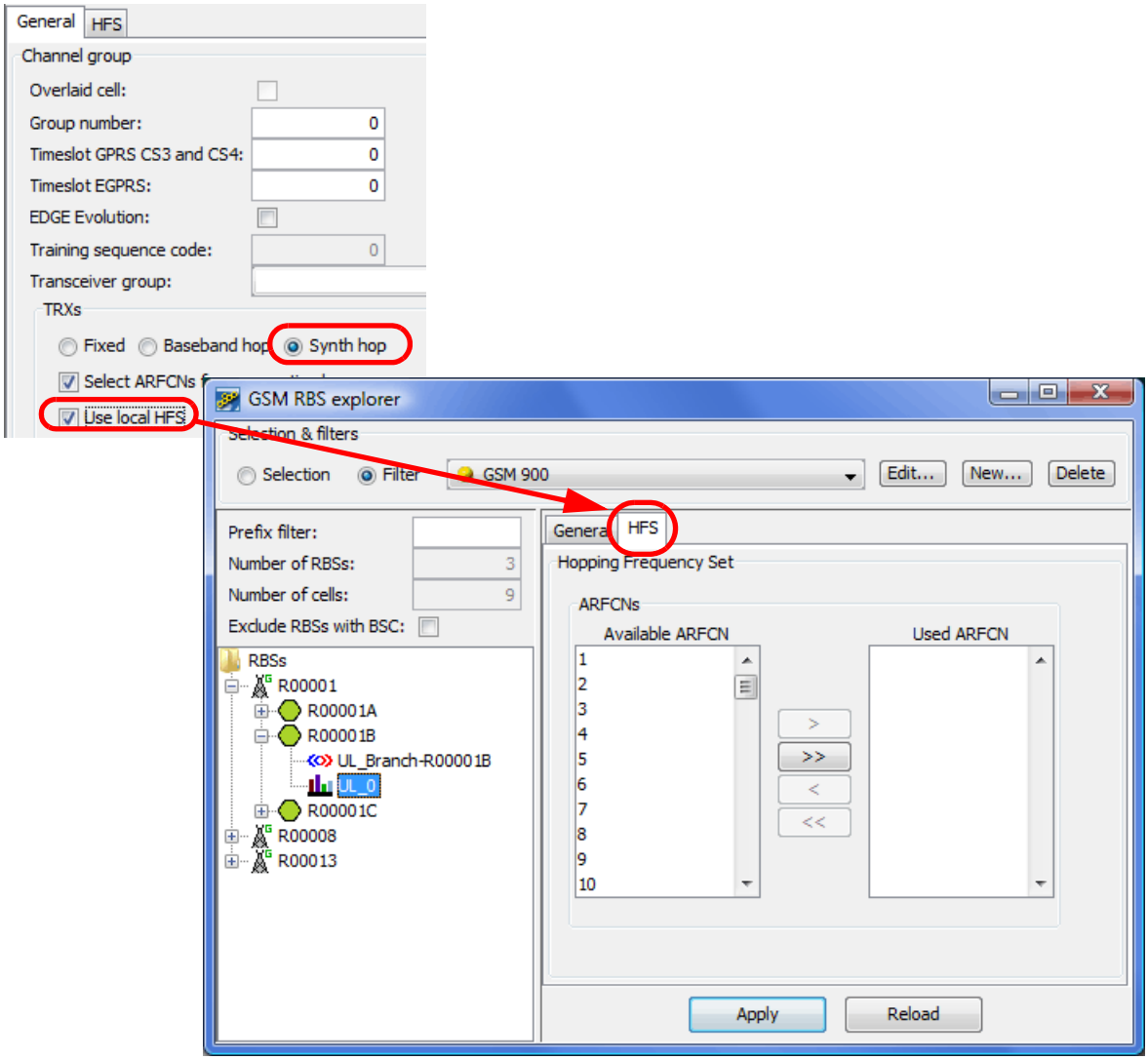


6. The example above shows a channel group for fixed frequency. If you select the **Synth hop** option, the option **Use local HFS** and the **Frequency planning** fields

(for HSN and MAIO planning) become enabled, as those are relevant only for synthesizer hopping TRXs. See example below:



7. For optimized frequency planning of synth hopping TRXs you can later use AFP for Synth Hopping to create a hopping frequency set (HFS). As an alternative you can select option **Use local HFS**, and define an HFS applicable only to this channel group under the **HFS** tab.



8. Add or change information as required.
9. Click **Apply** to preserve the channel group information.

Fields on Window “Channel group”

Overlaid cell	Read-only. Indicates that the channel group is defined for an overlaid sub-cell. By default, the channel group is assigned to underlaid sub-cell.
Group number	Number of the channel group. If the channel group is allocated to an overlaid sub-cell, the group number is prefixed with **OL** For an underlaid-cell allocation the group number is prefixed with **UL**. Range: 0 - 15.
Timeslot GPRS CS3 and CS4	Number of timeslots used for GPRS coding schemes CS3 and CS4. Range: 0 - 128. Initial value = 0.
Timeslot EGPRS	Number of timeslots used for EGPRS. Range: 0 - 128. Initial value = 0.
EDGE Evolution	Enables analysis of EDGE Evolution traffic. This option is used in conjunction with parameter **Timeslot EGPRS**, which must be > 0 to generate any EDGE Evolution traffic. When at least one timeslot is enabled for EDGE evolution, the Best Server Analysis, Traffic Performance Analysis and the Interference Analysis assumes that the number of EDGE evolution enabled timeslots in the channel group is equal to the number of timeslots enabled for EGPRS.
Training sequence code	Enabled when option *Overlaid cell* is selected. Range: 0 - 7. Initial value = 0. Refer to the *TEMS CellPlanner GSM Technical Reference Manual* for information on how this parameter is used.
TRXs: - ARFCN allocation (carrier allocation)	
Fixed	Fixed frequency. No frequency hopping is used.
Baseband hop	Frequency hopping uses baseband hopping.
Synth hop	Frequency hopping uses synthesizer hopping.
Select ARFCNs from respective layer	Carrier channels selected only from the currently selected layer.
Use local HFS	Relevant only when **Synth hop** is selected. Enables the **HFS** tab for definition of a hopping frequency set for this channel group only.
Number of TRXs	Number of TRXs in the channel group. The order of TRXs is according to the position of the TRX.

(list of TRXs)	A table showing for each TRX: • TRX type (BCCH or TCH) • Frequency group set • Frequency group - If assigned, a synthesizer hopping frequency group applies to all carriers in the channel group and cannot be set for individual TRXs. Must always be set for a synthesizer hopping channel group. • ARFCN - If assigned, the allocated BCCH carrier is not available for a synthesizer hopping TCH TRX. The BCCH in the OL sub-cell is not implemented. • Locked - A locked TRX means that optimizing a frequency plan cannot change the ARFCN allocation for the TRX. • EDGE capable TRX - Used for the Delta ETRX plots. Example: If the analysis results in 3 required ETRXs (EDGE capable TRXs), and only 1 TRX (BCCH or TCH) has this option selected, two more ETRXs are needed. ***Note:*** *This option has no influence on whether the cell is EDGE capable or not. That is determined by the parameter* ***Timeslot EGPRS*** *being >0.*
Assign ARFCNs from frequency group	Assigns ARFCNs from the selected frequency group to TRXs
Frequency planning	
SDCCH not hopping	Indicates frequency hopping is not used on the SDCCH time slot.
HSN	Hopping sequence number (HSN) used for the frequency group
MAIO numbers	List of Mobile Allocation Index Offset (MAIO) numbers. MAIO numbers are frequency offsets that provide necessary frequency separation. They are assigned to each frequency hopping TRX in the channel group. The MAIO numbers minimize the interference within sites using synchronized frequency hopping with a frequency offset. Each TRX in a hopping channel group must have a different MAIO number. Connections using the same hopping frequency set (HFS) and hopping sequence number (HSN) must have different MAIOs. The MAIO values are used only when both the serving cell and the interfering cell co-sited, and the RBS option **Synchronized** is enabled.
All MAIO numbers	All MAIO numbers available for the channel group.
Used MAIO numbers	MAIO numbers used in the channel group.

Define Custom Attributes for GSM Cells

You can define attributes per GSM cell, to be shown on the map display.

Refer to the *TEMS CellPlanner Common Features User's Guide* for more information on custom attributes.

Antenna Branches

A GSM antenna branch defines the antenna type, propagation model, and antenna equipment to use in the cell. For more information, see About Antenna Branches on page 8-15.

Add Antenna Branches to GSM Cells

Use this wizard-like procedure to add antenna branches to GSM cells. The "wizard" forces you to set some mandatory parameters. How to set the other parameters is described in subsequent sections.

Prerequisites

- The GSM cell is added to the RBS, see Add GSM Cell to an RBS on page 9-10.
- The propagation model to use is defined, see *Propagation Models* in the *TEMS CellPlanner Common Features User's Guide*.
- The antenna type to use is defined, see Antenna Types on page 7-3.

  Note: *If the cell is an underlaid/overlaid cell, the antenna type must support the frequency bands of both sub-cells.*

- An antenna is defined in the antenna system.
- If TMAs belong to the site equipment, the TMA type shall be defined, see TMA Types (Optional) on page 7-3, and the TMA be defined in the antenna system.
- If feeder cables belong to the site equipment, the feeder cable type shall be defined, see Feeder Cable Types (Optional) on page 7-3, and the feeder cable be defined in the antenna system.

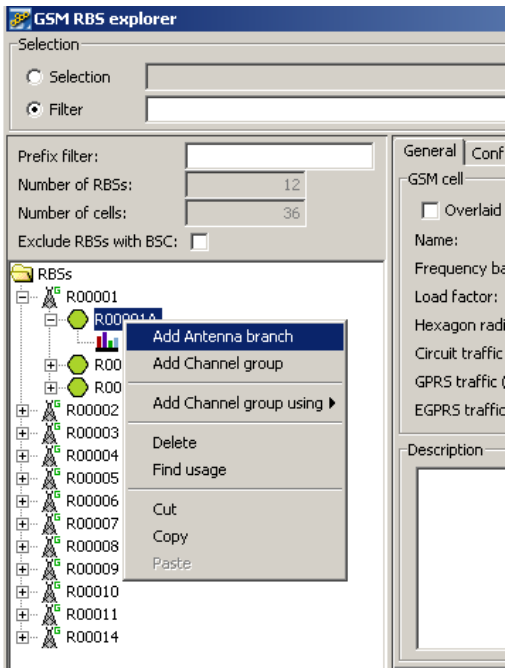
Procedure

Follow the steps below to add antenna branches to GSM RBSs. The windows referred are included in subsequent pages.

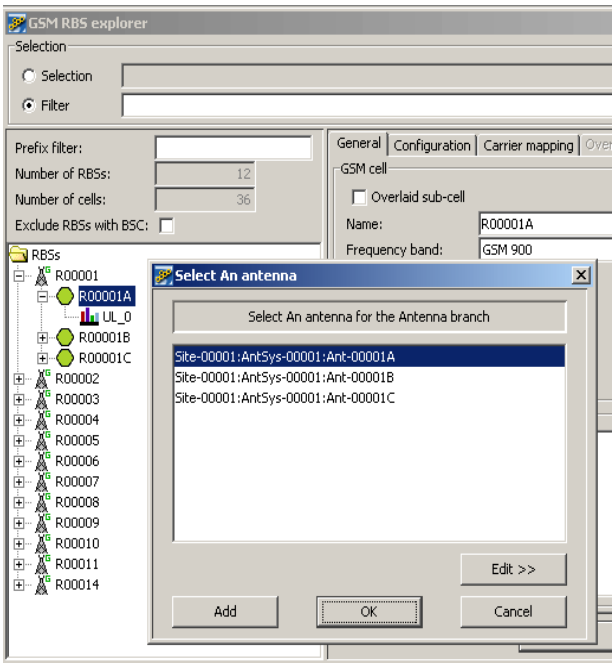
1. Select **Utilities↗GSM RBS explorer** or **Utilities↗Site explorer**.
2. Right-click a GSM cell in the tree and select **Add antenna branch** from the menu (window A). The **Select an antenna** window appears (window B).
3. Select an antenna from the list and click **OK**. The **Select an antenna branch type** window appears (window C).
4. Select an antenna branch type from the list and click **OK**. The **Select a propagation model** window appears (window D).
5. Select a propagation model from the list and click **OK**. The **Antenna branch - General** tab appears.
6. Proceed with Step 3 in Configure Antenna Branch General Parameters.

The windows below appear when you define an antenna branch:

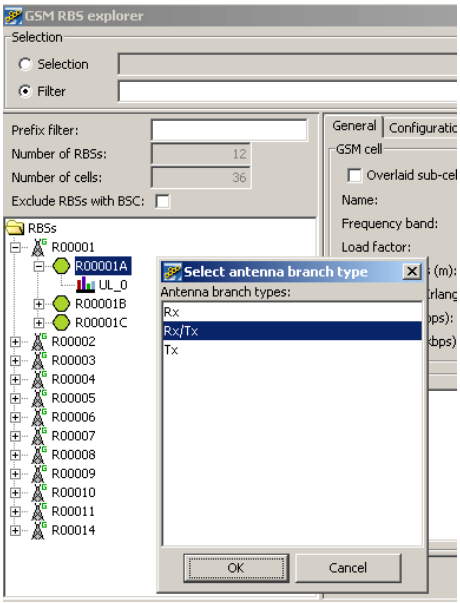
A) Add antenna branch:



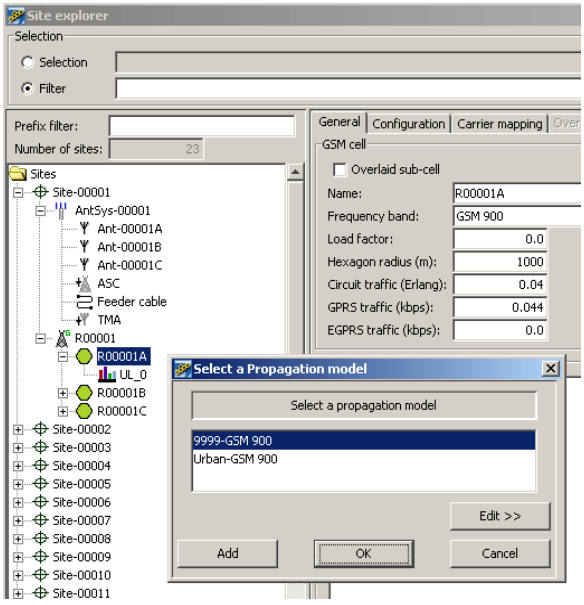
B) Select antenna:



C) Select antenna branch type:



D) Select propagation model:



Fields on the Windows

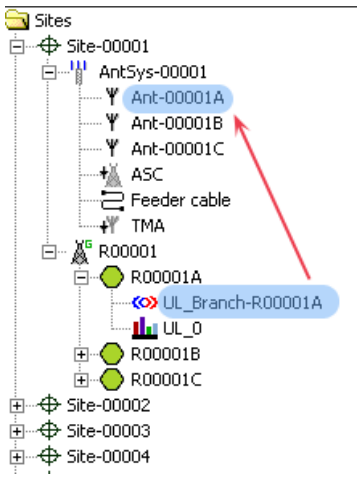
A) **Menu** with possible operations on a GSM cell.

B) Window **Select antenna for the Antenna branch**.

The predefined antennas are listed according to a syntax following the hierarchy in the **Site explorer:**

```
Site <space> Antenna system:Antenna
```

The example below shows antenna `Site-00001 AntSys-00001:Ant00001A` as selected for antenna branch `UL_Branch-R00001A`:



C) Window **Select antenna branch type**.

The selectable antenna branch types are as follows:

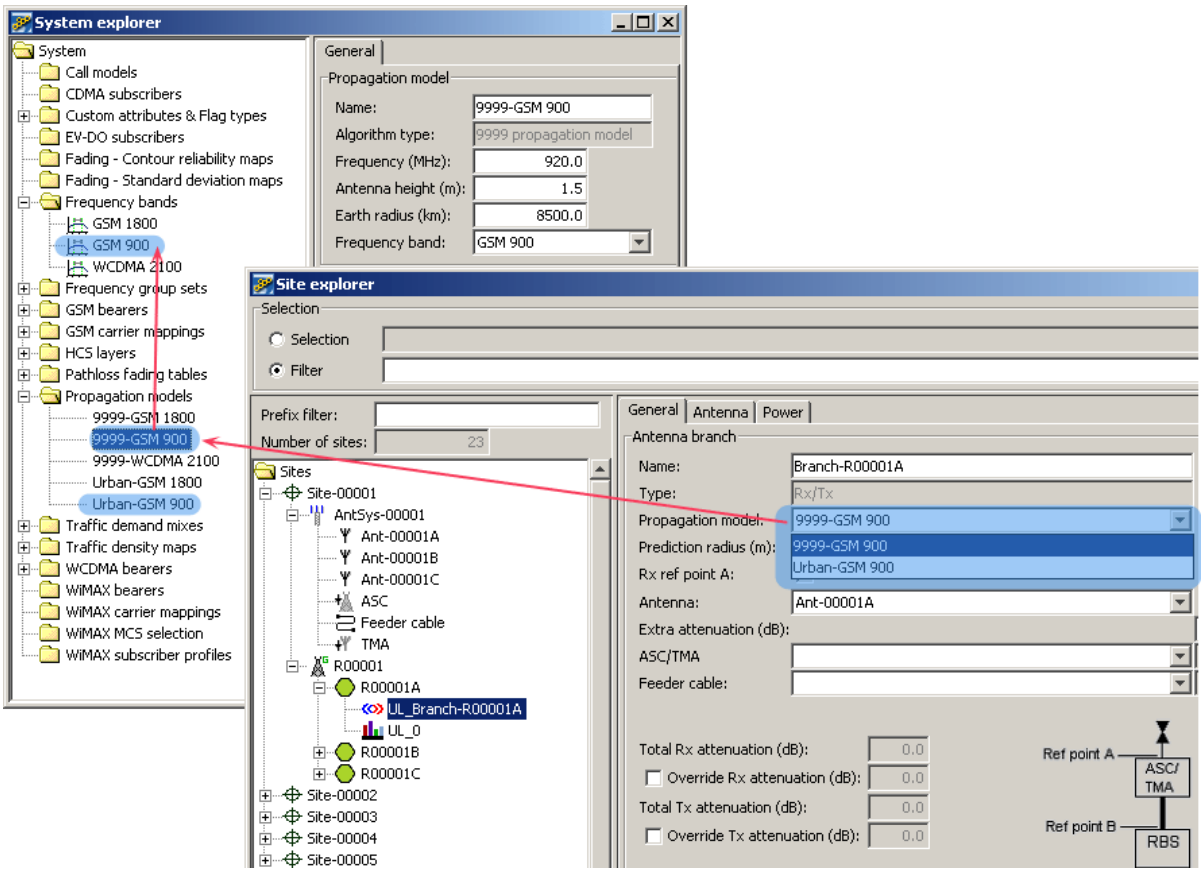
Rx	The antenna of the antenna branch is receiving only
Rx/Tx	The antenna of the antenna branch receives and transmits
Tx	The antenna of the antenna branch is transmitting only

D) Window **Select propagation model**.

The predefined propagation models allowed for the frequency band are listed.

The example below shows the propagation model relations between the antenna branch in the **Site explorer** (or **GSM RBS explorer)** and the propagation model and frequency band definitions in the **System explorer**:

In the example, propagation model `9999-GSM900` is selected for antenna branch `UL_Branch-R00001A`:



Configure Antenna Branch General Parameters

Use this procedure to configure general parameters of an antenna branch.

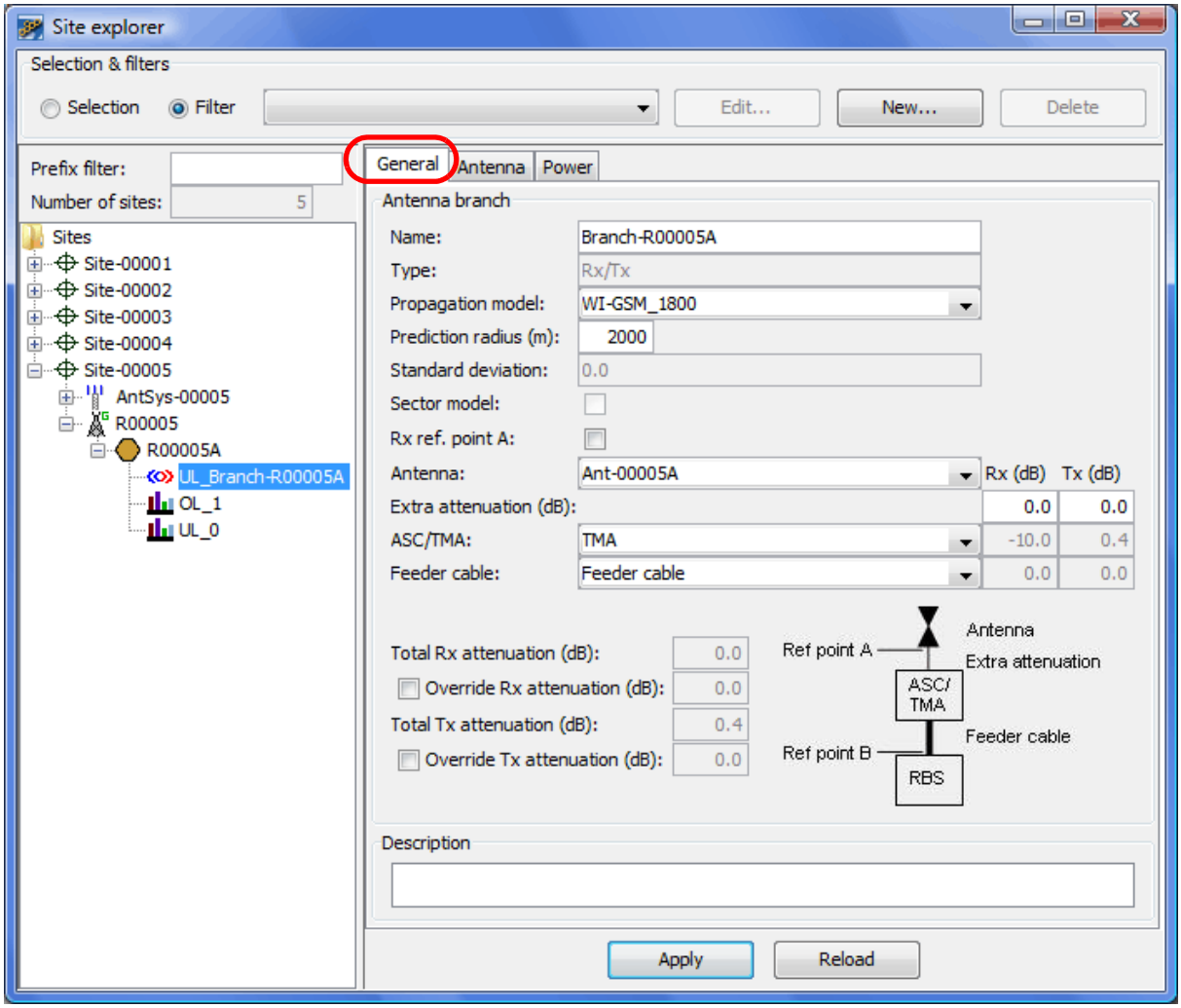
Prerequisites

- The antenna branch is added to the GSM cell, see Add Antenna Branches to GSM Cells on page 9-33.
- The propagation model to use is defined, see *Propagation Models* in the *TEMS CellPlanner Common Features User's Guide*.
- The antenna system to use is defined, see Antenna Systems on page 9-4.
- The TMA type to use is defined, see TMA Types (Optional) on page 7-3.
- The feeder cable type to use is defined, see Feeder Cable Types (Optional) on page 7-3.

Procedure

Follow these steps to configure general parameters of an antenna branch:

1. Select **Utilities↗Site explorer** (or **Utilities↗GSM RBS explorer**).
2. Select the GSM cell's antenna branch in the browser to open the **Antenna branch** window and select the **General** tab.



3. Add or change information as required, see Fields on Window "Antenna branch - General" on page 9-38.
4. Click **Apply** to preserve the antenna branch information.

Proceed with Configure Antenna Branch Antenna Parameters on page 9-39.

Fields on Window “Antenna branch - General”

Overlaid cell	Appears only if you have defined an overlaid sub-cell for the cell. Not displayed in the example window. If selected, this antenna branch is used for the overlaid sub-cell. If cleared, this antenna branch is used for the underlaid sub-cell.
Name	Name of the antenna branch. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Type	Type of transmission of the antenna branch: Rx, Tx, or both.
Propagation model	Propagation model used by the antenna branch. If you have created a dual-band cell and you select the Overlaid cell option, this propagation model is valid for the overlaid sub-cell.
Prediction radius (m)	Radius in meters covered by the propagation model. Range: 0 - 200000. Default = 2000.
Standard deviation	Used only when ASMT has been performed. Shows the standard deviation in decibels of the tuned propagation model for the sector.
Sector model	Automatically selected when a tuned propagation model exists for the sector
Rx ref point A	Indicates that the antenna losses are calculated from Reference Point A. See picture in the window.
Antenna	The antenna referred from the antenna branch
Extra attenuation (dB)	Extra UL and DL loss values in decibels, added to the Total Rx attenuation and Total Tx attenuation respectively. Range 0 - 50. Default = 0.
ASC/TMA	Indicates whether the antenna uses an antenna system controller (ASC) or tower mounted amplifier (TMA). ASC is used in WCDMA networks only.
Feeder cable	Feeder cable used with the antenna branch
Total Rx attenuation (dB)	Total UL attenuation in decibels, summed up by attenuation contributions from all equipment in the antenna branch. Not used if Override Rx attenuation is selected. Range: 0 - 100. Default = 0.
Override Rx attenuation	If selected, the associated attenuation value overrides the Total Rx attenuation. Range: 0 - 100. Default = 0.
Total Tx attenuation (dB)	Total DL attenuation in decibels, summed up by attenuation contributions from all equipment in the antenna branch. Not used if Override Tx attenuation is selected. Range: 0 - 100. Default = 0.
Override Tx attenuation	If selected, the associated attenuation value overrides the Total Tx attenuation. Range: 0 - 100. Default = 0.
Description	Description of the antenna branch

Configure Antenna Branch Antenna Parameters

Use this procedure to configure downtilt, azimuth and height of an antenna.

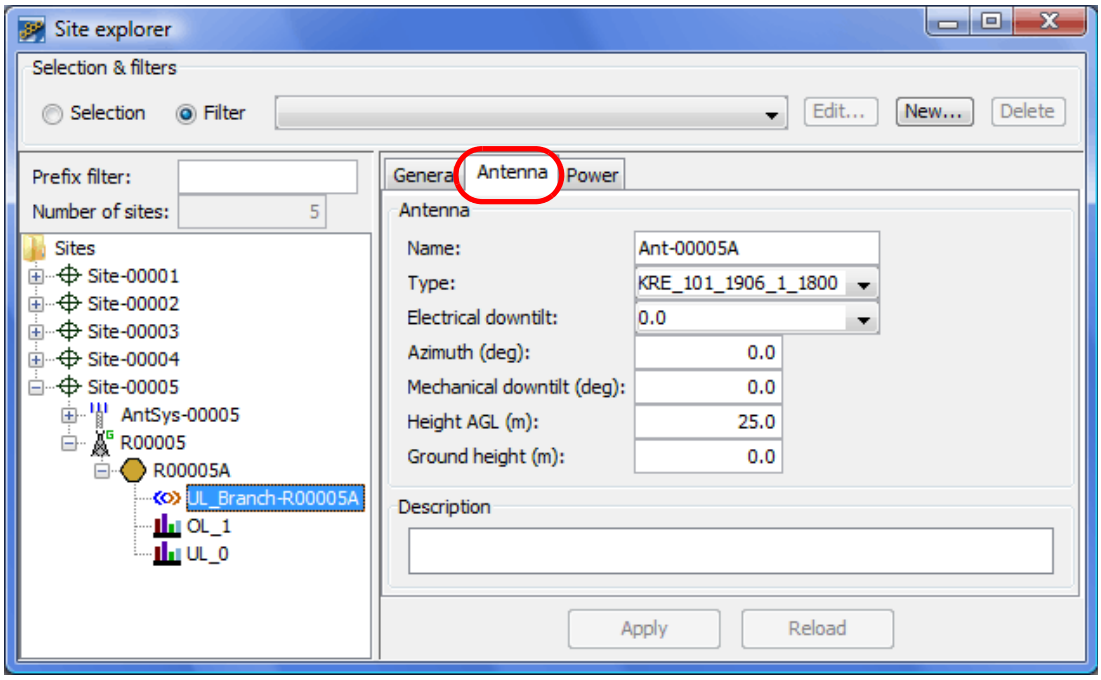
Prerequisites

- The antenna branch is added to the GSM cell, see Add Antenna Branches to GSM Cells on page 9-33.
- The antenna type to use is defined, see Antenna Types on page 7-3.
  If this is a dual-band cell, the antenna type must support the frequency band of the underlaid as well as the overlaid sub-cell.

Procedure

Follow these steps to configure the antenna parameters of an antenna branch:

1. Select **Utilities↗Site explorer** (or **Utilities↗GSM RBS explorer**).
2. Select the GSM cell's antenna branch in the browser to open the **Antenna branch** window and select the **Antenna** tab. The **Antenna** window is displayed.



3. Add or change information as required.
4. Click **Apply** to preserve the antenna information.
5. Proceed with Configure Antenna Branch Power Parameters on page 9-40

Fields on Window “Antenna branch - Antenna”

Name	Name of the antenna. The characters *A* and *B* indicate different antennas. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Type	Antenna model
Electrical downtilt	The electrical downtilt angle in degrees. Range 0 - 90. Default = 0.
Azimuth (deg)	Beam direction in degrees, calculated clockwise from north. Range 0-360. Default = 0.
Mechanical downtilt (deg)	Mechanical downtilt in degrees relative to the vertical plane. The tilt angle is fixed and set when the antenna is mounted. Range: -90 to 90. Default = 0.
Height AGL (m)	Antenna height in meters above ground level. Range -200 - 4000. Default = 25.
Ground height (m)	Antenna height in meters above the 0 (zero) level of the elevation map. If you set this to another value than 0, you override the elevation map at this position. Range 0-600. Default = 0.
Description	Description of the antenna branch.

Configure Antenna Branch Power Parameters

Use this procedure to configure power settings of an antenna, or to configure a cable repeater.

Prerequisites

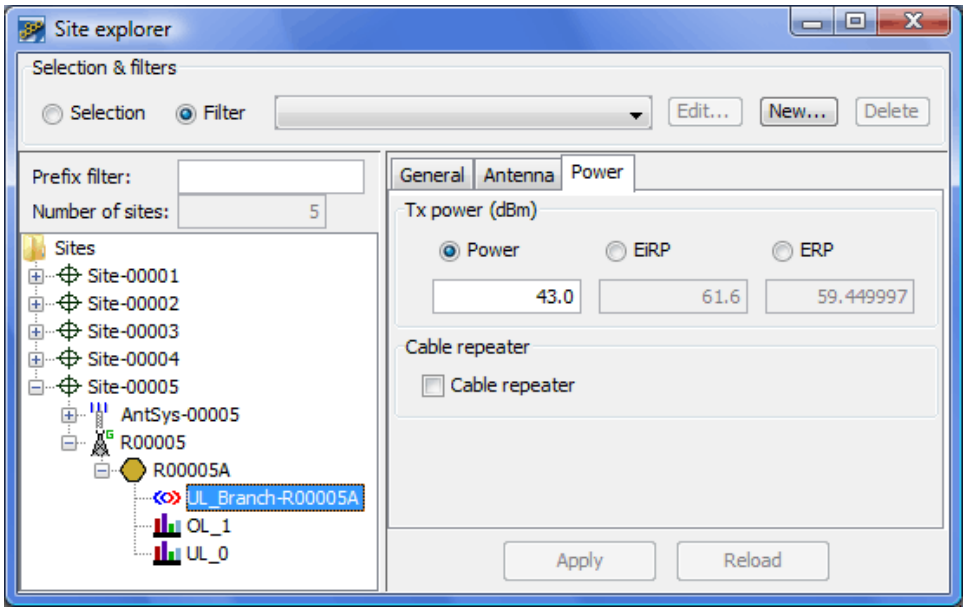
- The antenna branch is added to the GSM cell, see Add Antenna Branches to GSM Cells on page 9-33.
- The antenna type to use is defined, see Antenna Types on page 7-3.

Procedure

Follow these steps to configure the power parameters of an antenna branch:

1. Select **Utilities↗GSM RBS explorer** or **Utilities↗Site explorer**.
2. Select a GSM cell in the tree. The **Antenna branch - General** window is displayed.

3. Select the **Power** tab. The **Power** window is displayed.



4. Add or change information as required, see Fields on Window "Antenna branch - Power" on page 9-41.

5. Click **Apply** to preserve the antenna power information.

Fields on Window "Antenna branch - Power"

Tx power (dBm)	Transmission power of the cell, measured in dBm. Affects received signal strength in Best Server Analysis. The type of tx power can be either of the following: • Power - Uses actual power from the antenna. • EIRP - Effective Isotropic Radiate Power. Multiplies the transmission power with the antenna gain referenced to an idealized isotropic antenna. • ERP - Effective Radiated Power. Multiplies the transmission power with the antenna gain referenced to an idealized dipole antenna.
Cable repeater	If selected, the antenna branch is considered to model a cable repeater. You can then set its Tx power independently of the Tx power of the cell.

Radio Repeaters

Radio repeaters may be added to your GSM network plan to amplify signals to/from donor cells. The radio repeaters are defined in the Site explorer.

Refer to the *TEMS CellPlanner Common Features User's Guide* for information on how to configure radio repeaters.

10
GSM Networks

This chapter describes how to define the network elements above the GSM RBSs in a GSM network plan.

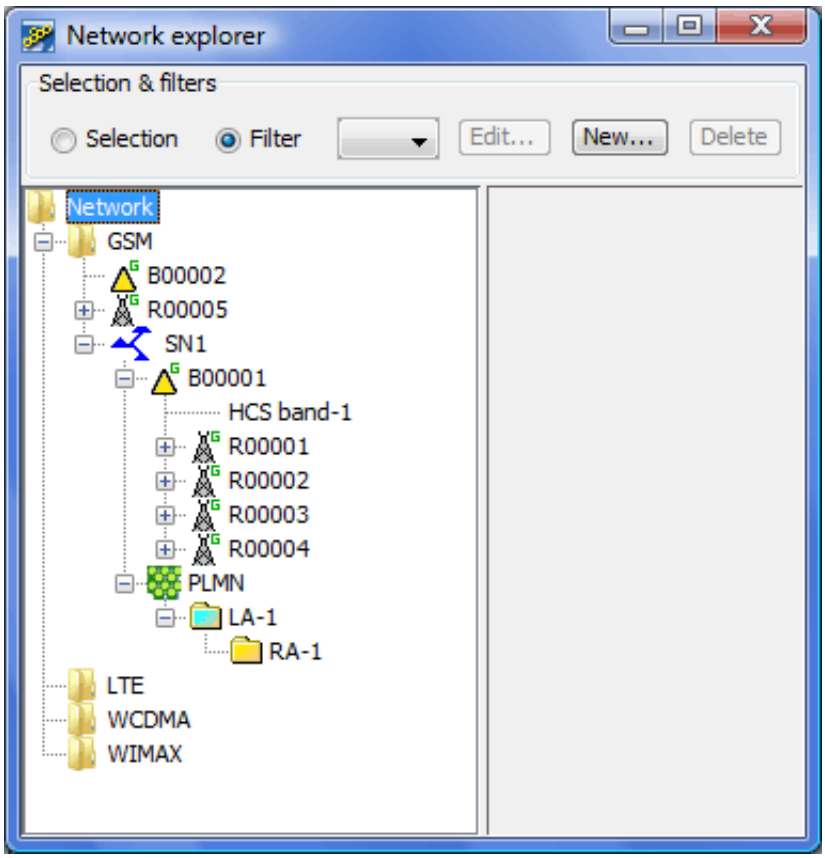
Topic **Page**

About the Network Explorer 10-2
Subnetworks, BSCs, PLMNs and LAs 10-3
- Add GSM Subnetwork 10-3
- Add GSM BSC 10-5
- Add PLMN 10-7
- Add GSM Location Area 10-8
- Add GSM Routing Area 10-9
- Connect GSM RBSs to BSC 10-10

About the Network Explorer

The **Network explorer** provides a network-level view of a plan. The explorer shows the logical network hierarchy and the interconnections between Subnetwork-GSM BSC and GSM BSC-GSM RBS. The explorer also shows how the network hierarchy is organized to distinguish between network technologies.

Use the Network explorer to add, modify and delete the network elements of a GSM network or subnetwork. Each object in the network hierarchy has a menu accessible with the right mouse button:



Tip: To add, modify and delete GSM RBSs, you can as well use the Site explorer or the GSM RBS explorer.

Subnetworks, BSCs, PLMNs and LAs

The uppermost network element in a GSM network topology is named *GSM network*, as displayed in the Network explorer.

The next levels of a GSM network include the following network elements:

- GSM BSCs, may include GSM RBS and HCS band
- Subnetworks, may include GSM BSCs and PLMNs, and PLMNs may include Location Areas (LA)
- GSM RBSs

Add GSM Subnetwork

Use this procedure to add GSM subnetworks to a GSM network.

Prerequisites

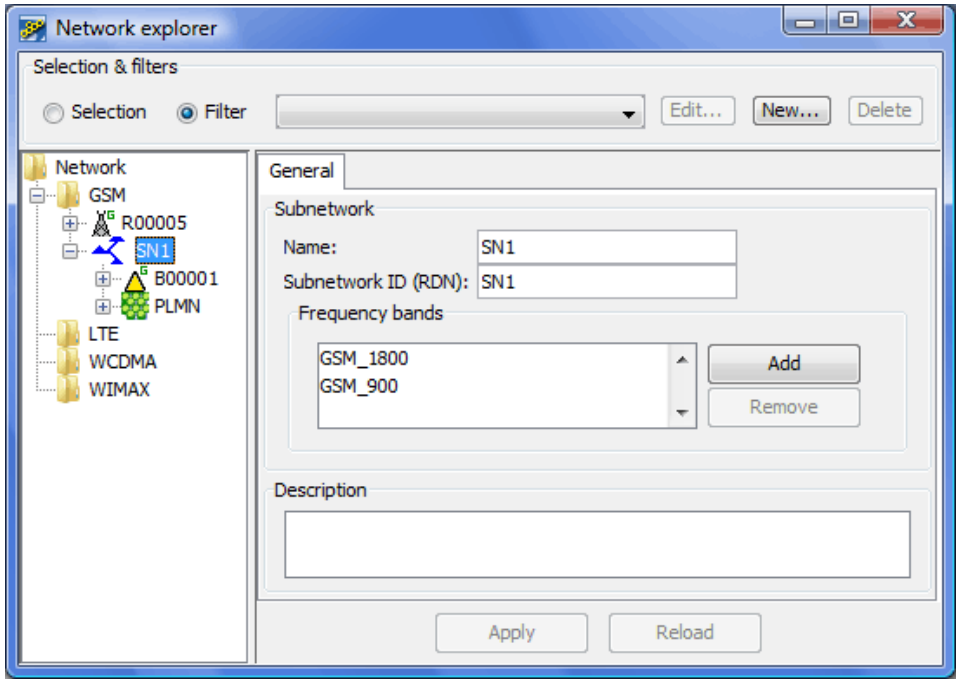
The frequency bands to be used by the subnetwork are defined, see Define GSM Frequency Bands on page 6-5.

Procedure

Follow these steps to add GSM subnetworks:

1. Select **Utilities↗Network explorer**. The window displays the Network folder with a GSM subfolder.
2. Right-click GSM, and select **Add Subnetwork** from the menu. The Select a Frequency Band window appears.

3. Select a previously defined frequency band for the subnetwork, or click **Add** to add a frequency band for the subnetwork. A subnetwork is created under the GSM level, and the **Subnetwork** window appears.



4. Enter information for the network and click **Apply**.

Fields on Window "Subnetwork"

Name	Name of the subnetwork. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Subnetwork ID (RDN)	Relative distinguished name (RDN) of the subnetwork.
Frequency bands	Frequency bands used by the subnetwork.
Add	Adds a frequency band to the subnetwork.
Remove	Removes a frequency band from the subnetwork.
Description	Description of the subnetwork.

Add GSM BSC

You can add GSM BSCs to your GSM network or subnetwork. A BSC is required to enable HCS, GPRS and MAIO planning, and to define HCS bands. A BSC is required also if you intend to export/import the GSM network plan to/from OSS.

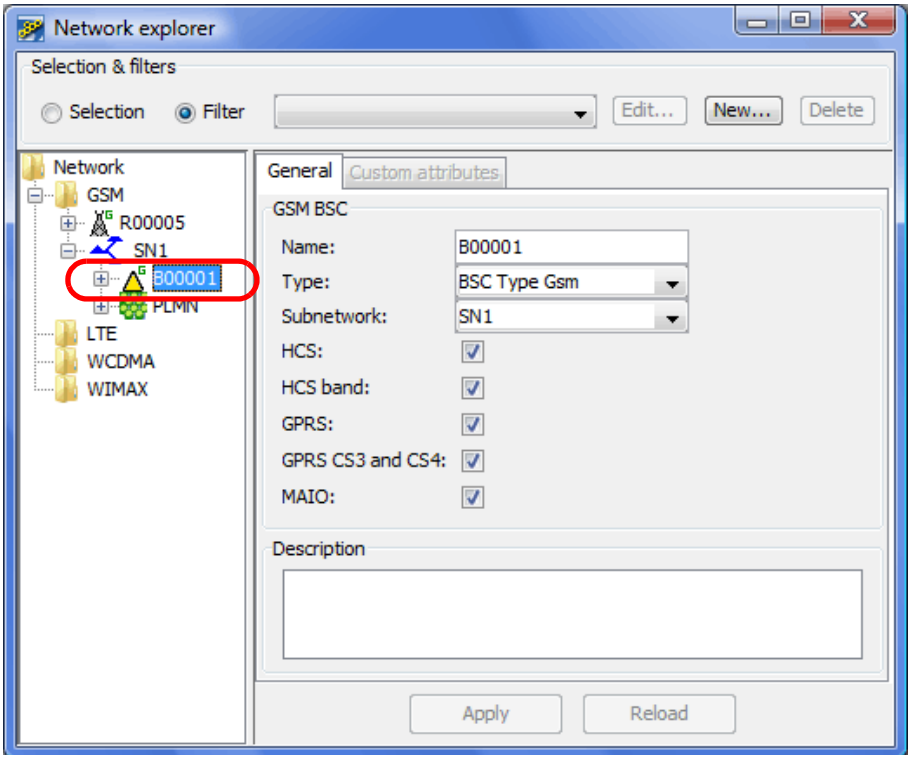
Prerequisites

- The GSM BSC type is defined (optional).
- A subnetwork to associate with this GSM BSC is defined (optional).
- If the GSM BSC shall support HCS, the HCS bands and HCS layers must be defined, see How to Configure HCS on page 11-3.

Procedure

Follow these steps to add GSM BSC to a GSM network or a subnetwork:

1. Select **Utilities↗Network explorer**. The window displays the possible networks.
2. To associate the GSM BSC to the GSM network, right-click on **GSM** and select **Add GSM BSC**. A BSC is created under the GSM level, and the **GSM BSC** window appears. To associate the GSM BSC to a subnetwork, right-click on the subnetwork in the browser and select **Add GSM BSC**. A BSC is created under the subnetwork, and the **GSM BSC** window appears as in the example below:



3. Enter the information for the GSM BSC.

   Note: *To re-associate a GSM BSC previously associated with the GSM network to a subnetwork instead, select the name from the Subnetwork list in the window or move the BSC by drag and drop.*

4. Click **Apply**.

Fields on Window "GSM BSC"

Name	Name of the GSM BSC. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Type	The GSM BSC type, see GSM BSC Types on page 7-4.
Subnetwork	The subnetwork to associate with this GSM BSC. If defined, the GSM BSC is graphically ordered under the subnetwork in the topology in the Network explorer.
HCS	Enables use of Hierarchical Cell Structure
HCS band	Enables use of Hierarchical Cell Structure bands
GPRS	Enables use of GPRS
GPRS CS3 and CS4	Enables use of GPRS CS3 and CS4
MAIO	Enables user of Mobile Allocation Index Offset
Description	Description of the GSM BSC

Add PLMN

You can add a PLMN to your GSM network or subnetwork. A PLMN is required to identify the mobile network and location areas (LA).

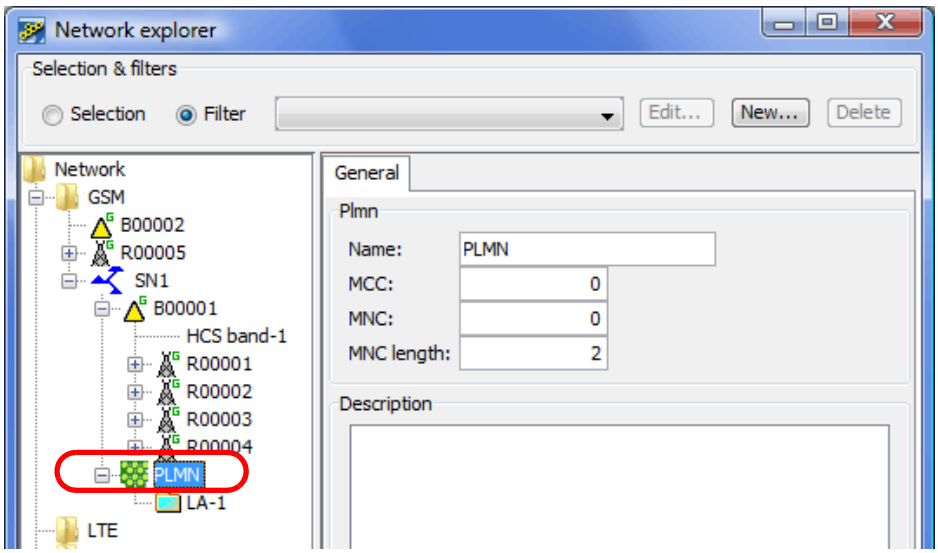
Prerequisites

The GSM subnetwork is defined, see Add GSM Subnetwork on page 10-3.

Procedure

Follow these steps to add a PLMN object to a GSM subnetwork:

1. Select **Utilities↗Network explorer**.
2. Locate the GSM subnetwork, right-click and select **Add PLMN**. A **PLMN** object is created under the subnetwork, and the **PLMN** window is displayed.



3. Enter the information for the PLMN.
4. Click **Apply**.

Fields on Window "PLMN"

Name	Name of the PLMN. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
MCC	Mobile country code. Range: 0 - 999. Default = 0.
MNC	Mobile network code. Range: 0 - 999. Default = 0.
MNC length	Length of mobile network code. Range: 2 - 3. Default = 2.
Description	Description of the PLMN

Add GSM Location Area

Location areas can be added to PLMNs only.

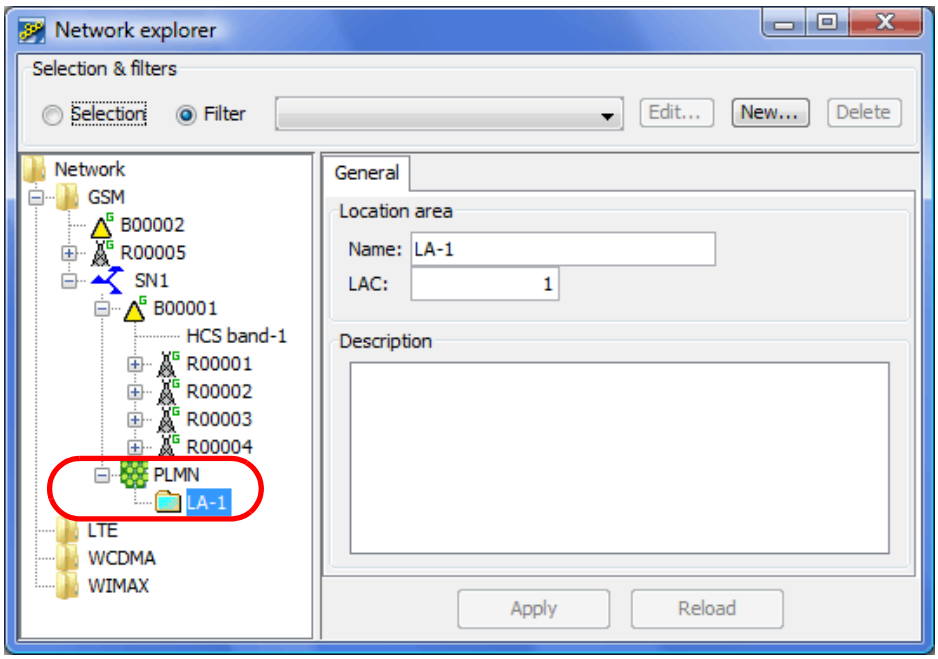
Prerequisites

The PLMN is defined, see Add PLMN on page 10-7.

Procedure

Follow these steps to add a location area:

1. Select **Utilities↗Network explorer**.
2. Locate the GSM subnetwork, right-click and select **Add Location area**. An LA object is created under the PLMN, and the Location area window appears.



3. Enter the location area code, LAC. If more LACs are needed, add more LACs below the subnetwork.
4. Click **Apply**.

Fields on Window "Location area"

Name	Name of the location area. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
LAC	Location area code. Range 1 - 65533. Default = 1.

Add GSM Routing Area

Routing areas can be added to Location Areas only.

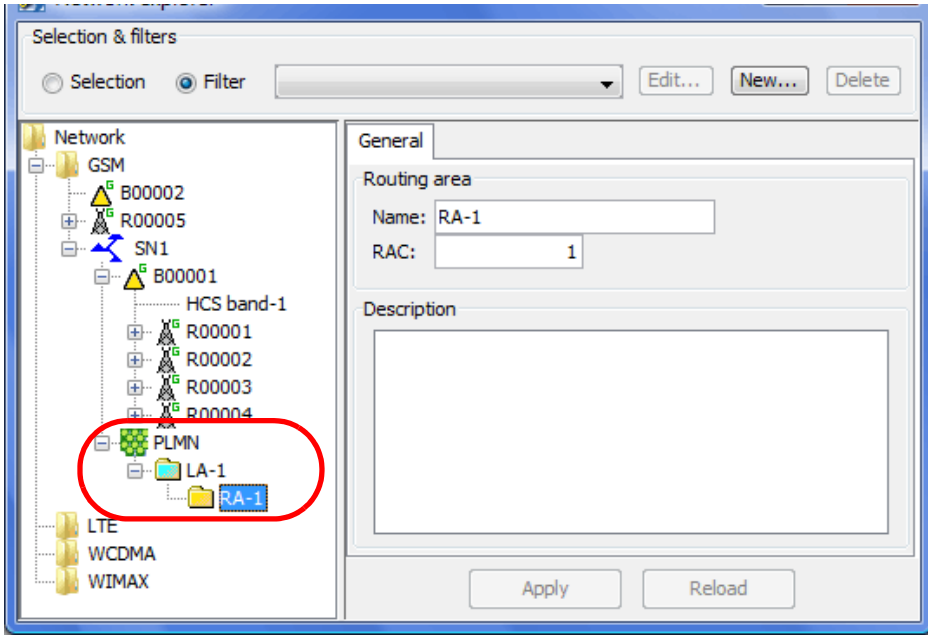
Prerequisites

The Location Area is defined, see Add GSM Location Area on page 10-8.

Procedure

Follow these steps to add a location area:

1. Select **Utilities↗Network explorer**.
2. Locate the GSM subnetwork, its PLMN and LA, right-click and select **Add Routing area**. An **RA** object is created under the LA object, and the **Routing area** window appears.



3. Enter the location area code, LAC. If more LACs are needed, add more LACs below the subnetwork.
4. Click **Apply**.

Fields on Window "Routing area"

Name	Name of the location area. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
RAC	Routing area code. Range 0 - 255. Default = 1.

Connect GSM RBSs to BSC

Use this procedure to connect GSM RBSs to a BSC.

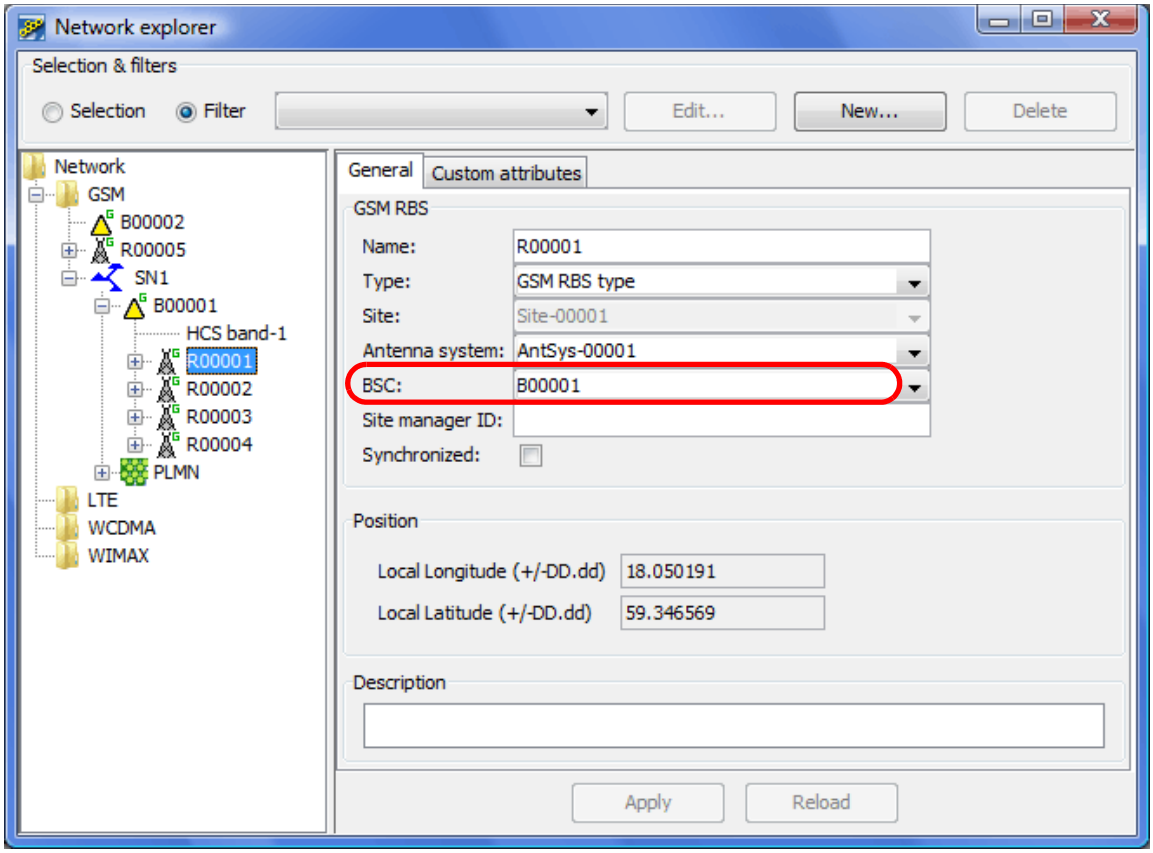
Prerequisites

- A BSC is defined as part of a subnetwork, see Add GSM BSC on page 10-5.
- RBSs are defined, see Add GSM RBS to a Site (Create From Template) on page 9-7

Procedure

Follow these steps to relate GSM RBSs to a BSC:

1. Select **Utilities↗Network explorer** and expand the **GSM** folder. The defined GSM RBSs and subnetworks are displayed.
2. Select an RBS to connect to a BSC. The **GSM RBS** window appears.



3. Select the BSC to connect to and click **Apply**. The RBS is moved down to the subnetwork's BSC.
4. Repeat from Step 2 until all RBSs to connect to the BSC have been connected.

11
Hierarchical Cell Structures (HCS)

This chapter describes the concepts of HCS and how to configure GSM cells and other network elements to use HCS.

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About Hierarchical Cell Structures (HCS) 11-2
HCS versus Overlaid/Underlaid Cells 11-2
HCS in TEMS CellPlanner 11-2
HCS Layer and Band Correlation. 11-2
How to Configure HCS 11-3
Define HCS Layers 11-3
Define HCS Bands of a GSM BSC 11-4
Configure HCS Parameters of a GSM Cell. 11-5

About Hierarchical Cell Structures (HCS)

Hierarchical Cell Structure (HCS) facilitate directing traffic into microcells to off-load the macrocells.

The macro- and microcells in an HCS capable GSM network are assigned different priorities. The HCS capable terminals consider these priorities when ranking the best server. The terminal can in this way choose a microcell as best server, even if the received power from a macrocell is higher.

HCS versus Overlaid/Underlaid Cells

There are similarities between HCS microcells/macrocells and overlaid/underlaid sub-cells, but they work in different ways.

The main differences are the following:

- An overlaid sub-cell must be co-located with an underlaid sub-cell, since only one of the sub-cells has a BCCH. A microcell has its own BCCH and can therefore be located wherever a capacity increase is required.
- An HCS microcell is chosen as best server based on priority and received power. An overlaid cell is chosen as best server based on limits on the pathloss and timing advance.

HCS in TEMS CellPlanner

GSM BSCs, cells and terminals can be configured to be HCS capable.

HCS capability is considered in the following parts of TEMS CellPlanner:

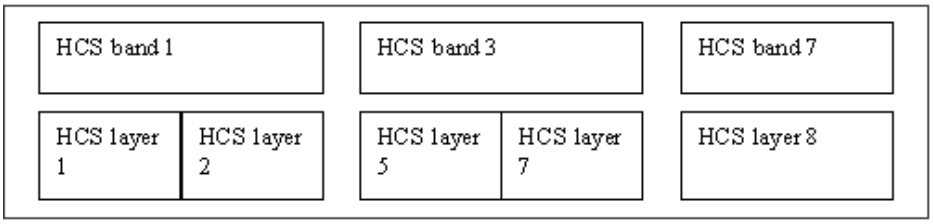
- Best server analysis
- Export to or import from GSM OSS-RC CNAI file

HCS Layer and Band Correlation

Different cells on the 900 and 1800 bands respectively are allowed to be included in the same HCS band, in its turn including one ore more HCS layers.

HCS layers with layer numbers in ascending order must be assigned to HCS bands with band numbers in ascending order. When a specific HCS layer has been assigned to a specific HCS band, another HCS layer with a higher layer number must be assigned to an HCS band with the same or a higher band number. An HCS layer with a lower layer number cannot be assigned to an HCS band with a higher band number.

The illustration below shows an example of five HCS layers assigned to three different HCS bands. You can make similar assignments for each BSC, where the value of the HCS band threshold [dBm] is assigned to each HCS band.



How to Configure HCS

A GSM network plan supporting HCS is configured as follows:

1. Define HCS Layers with priorities for macro- and microcells.
2. Define HCS Bands of a GSM BSC controlling GSM RBSs with HCS cells. Here you also define the HCS bands per HCS layer.
3. Configure HCS Parameters of a GSM Cell per HCS capable GSM cell.
4. Configure GSM Terminal Types with HCS capability (slow terminals).

Define HCS Layers

To use HCS in your network plan, you need to define the micro- and macrocell priorities in HCS layers.

Prerequisites

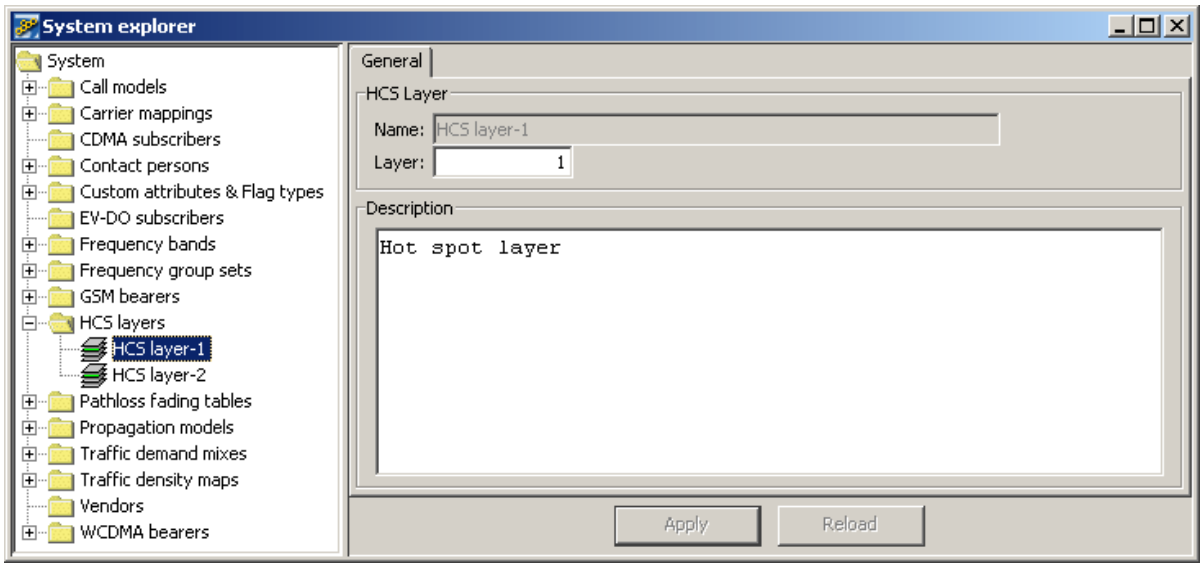
A GSM project is open.

Procedure

Follow these steps to define HCS layers for your GSM network plan:

1. Select **Utilities ↗System explorer**.

2. Right-click the **HCS layers** folder, and select **Add HCS layer**. The **HSC layer type - General** tab is displayed:



3. Add or change information as required.
4. Click **Apply** to preserve the HCS layers.

Fields on Window "HCS layer"

Name	The name of the GSM HCS layer. The name is automatically set to "HCS layer-x", where x is the layer number. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Layer	Layer number, or rather the priority of the HCS layer. Range 1-8. The lowest number corresponds to the highest priority. One macrocell layer and at least one microcell layer are needed. (For Ericsson's BSS release R7 and earlier, there are however only one HCS band and three HCS layers.)
Description	Description of the GSM HCS layer. Typically the highest prioritized layer is a hot spot layer.

Define HCS Bands of a GSM BSC

To use HCS in your network plan, you need to define the HCS bands per GSM BSC.

Prerequisites

- The HCS layers are defined, see Define HCS Layers on page 11-3.
- The GSM BSC controlling GSM RBSs with HCS cells is added to the GSM network, see Add GSM BSC on page 10-5.

Procedure

1. Open the **Network explorer** and locate the GSM BSC.
2. Right-click and select **Add HCS band.** An HCS band is created.

Fields on Window "HCS band"

Name	The name of the HCS band. Initially named "HCS band-x", where x is a sequential number of HCS bands of the GSM BSC. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.
Band threshold	The threshold of the HCS band in dBm. If the signal strength in the cell exceeds this band threshold, the cell will be prioritized according to its HCS band. Otherwise, the cell will be prioritized according to its HCS layers and HCS layer thresholds only. Range -150 to 0. Default = -75.
Band number	The number of the HCS band. The dependency between HCS band numbers and HCS layers is described in HCS in TEMS CellPlanner on page 11-2.
HCS layers	An HCS band can include several HCS layers. An HCS layer can only belong to one HCS band of a GSM BSC. The HCS layers are selected from the list defined in HCS in TEMS CellPlanner on page 11-2. The dependency between HCS band numbers and HCS layers is described in HCS in TEMS CellPlanner on page 11-2.
Add	Add the selected HCS layer
Remove	Remove the selected HCS layer
Description	Description of the GSM HCS layer. Typically the highest prioritized layer is a hot spot layer.

Configure HCS Parameters of a GSM Cell

To use HCS in your network plan, you need to assign the HCS parameters of the HCS capable GSM cells.

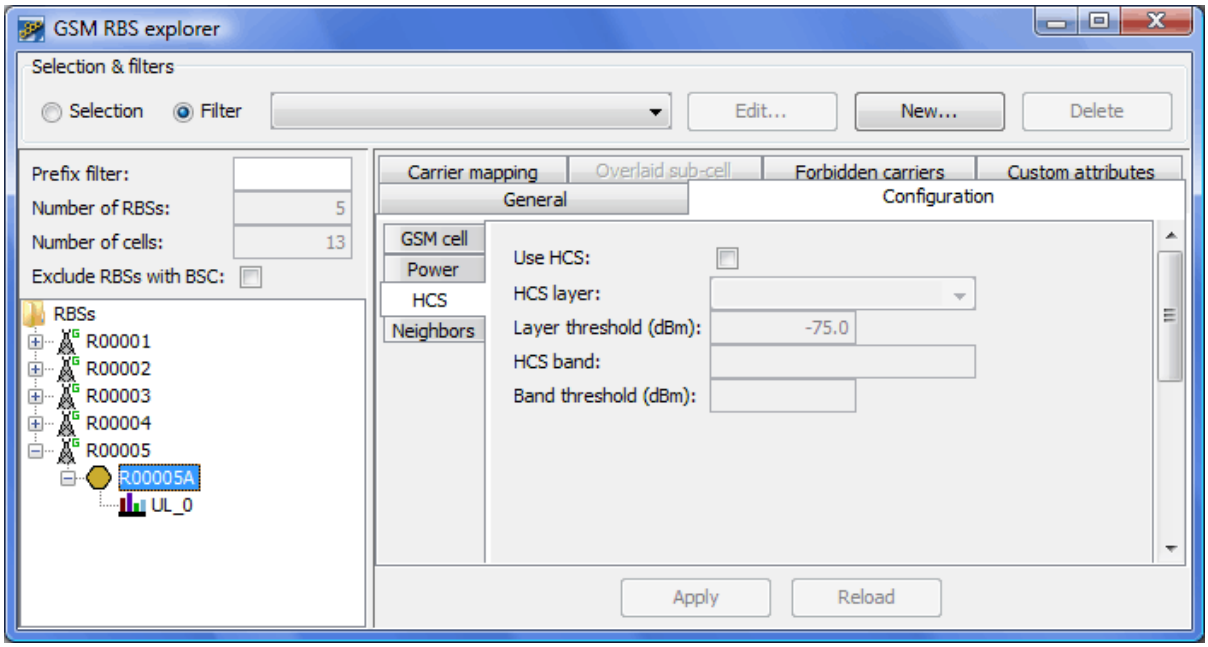
Prerequisites

- The HCS bands of the GSM BSCs controlling GSM RBSs with HCS cells are added, see Define HCS Bands of a GSM BSC on page 11-4.
- The GSM RBS*s* with HCS cells are associated with their respective GSM BSC. This is displayed in the Network explorer as the GSM RBS being a network element under its GSM BSC in the network topology.

Procedure

1. Select the GSM cell in an explorer.

2. Open the **Configuration** tab and the **HCS** sub-tab as in the following example:



Fields on Window "GSM cell - Configuration - HCS"

Use HCS	Indicates using hierarchical cell structure for the cell.
HCS layer	Pre-defined HCS layer. Each HCS capable GSM cell must be associated with an HCS layer within an HCS band.
Layer threshold (dBm)	HCS layer threshold for the cell in dBm. The purpose of this threshold is to avoid prioritizing cells with too low signal strength. The cells belonging to the same HCS layer do not need to have the same layer threshold. Range -150 to 0. Default = -75.
HCS band	HCS band to use with the cell. Select the HCS bands from the GSM BSC element in the Network explorer.
Band threshold (dBm)	HCS band threshold in dBm for the cell.

12
Filters

Filters limit the operations on a GSM network plan, logically or geographically.

Read chapter *Filters* in the *TEMS CellPlanner Common Features User's Guide* to learn more on this topic.

13
Import and Export of GSM Data

This chapter describes how to import and export GSM related data such as neighbor lists and interference tables.

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Import and Export of GSM Neighbor Lists 13-2
- Import Neighbor Lists 13-3
- Export Neighbor Lists 13-3

Import and Export of Interference Tables 13-4
- Import Interference Tables 13-4
- Export Interference Tables. 13-4

Import and Export of OSS-RC GSM Network Data 13-7
Import and Export of CellOpt AFP Data 13-7
- Export Frequency Plan to CellOpt AFP XML File. 13-7
- Import Frequency Plan from CellOpt AFP XML File 13-8

Import and Export of Other Data 13-9

About Import and Export of GSM Data

You can import/export the following GSM specific data to/from a GSM project:

- GSM cell data
- GSM carriers
- GSM neighbor lists
- GSM interference tables
- OSS-RC GSM network data
- CellOpt AFP data

You can also import/export generic (non-GSM) data as described in Import and Export of Other Data on page 13-9.

Import and Export of GSM Cell Data

You can export / import GSM cell data of two different file formats:

Cells Text File

Exportable from and importable into TEMS CellPlanner.

TEMS XML Cell Data File

Files of this type can only be exported from TEMS CellPlanner. TEMS optimization and tuning tools can import files of this format to use the same cell names and positions as in TEMS CellPlanner.

Refer to *TEMS CellPlanner Common Features User's Guide* for more information.

Import and Export of GSM Carriers

Refer to *TEMS CellPlanner Common Features User's Guide* for more information.

Import and Export of GSM Neighbor Lists

This import option imports the neighbor lists to the default calculation results directory of TEMS CellPlanner.

To import cell neighbor data directly into the project, you must use the Import cell neighbors text file option, described in the *TEMS CellPlanner Common Features User's Guide*.

Import Neighbor Lists

Use this procedure to import neighbor lists for use with the neighbor analysis functions in a specified text format.

If neighbor relations already exist in the database, you can replace the old relations with the imported relations, or you can merge the two sets of relations.

When you merge neighbor lists, you can indicate higher or lower priority for the old relations.

TEMS CellPlanner places the imported relations on the neighbor candidate list in priority order and in the same order as they had in the input file. If duplicate relations exist, the relation with the lowest priority is merged into the relation with highest priority. After the import is finished, the program limits the number of relations.

Prerequisites

You must have an existing neighbors file to import.

Export Neighbor Lists

Do as follows to export a neighbor list:

1. Click **Export neighbor list**. The Export File Selection window opens.
2. Specify a path and name for the export file.
3. Click **OK**.

The export file has a line for every cell. Each line contains cells separated by tabs. The first cell is the serving cell while the rest of the cells are neighbors.

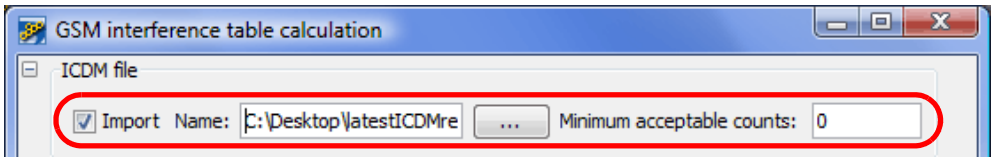
Import and Export of Interference Tables

You can import Import Interference Tables from an ICDM file including interference values from a live network, and Export Interference Tables for post-processing.

Import Interference Tables

When you Calculate and/or Import Interference Tables, you can import values from an ICDM file containing measured interference values. The imported values are stored internally and may later be used for Automatic Frequency Planning (AFP).

Initiate the import by selecting the **Import** option:



Interference values for a certain cell-pair are imported only if the number of measurements of the cell-pair is higher than a configured minimum number of required measurements.

Values might be missing in, or not be importable from, the import file. To ensure that all cell-pairs get at least predicted values, set non-zero Weight Settings when you Calculate and/or Import Interference Tables.

Export Interference Tables

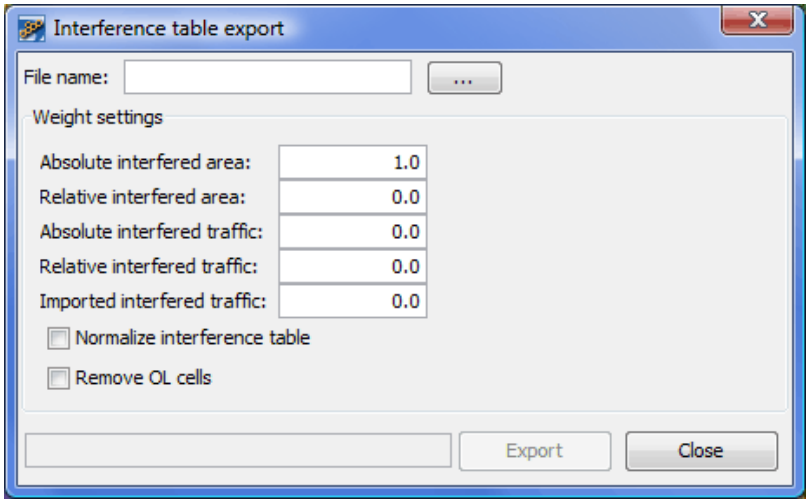
You can Export Interference Tables to facilitate external post-processing. When exporting, all interference values for a given cell pair are aggregated into two values (one for co-channel and one for adjacent channel interference). This process is controlled by weight settings in the export dialog, where weights are specified for absolute and relative area and traffic, and also for imported interference. Finally, the aggregated values are divided by the number of TRXs in the interfered cell.

The range for relative interfered area, relative interfered traffic, and imported interference is 0.1. Total interfered area is given in square kilometers. The unit for total interfered traffic depends on the type of the contributing traffic cases (Erlang for voice, kbps for GPRS/EGPRS).

Procedure

Follow these steps to export an interference table:

1. Select **File↗Export↗Interference table.** The **Interference table export** window is displayed.



2. Enter the name for the interference table in the **Interference table export** window. You can use an existing file, or you can enter a new file name.
3. Set the weight factors for absolute and relative area and traffic (4 factors) plus imported traffic (1 factor).

   If you set the first four weight factors to the same values, the parameter with the largest value (for example absolute interfered traffic) dominates the weighted average.

   If you set the last factor to a positive value, the imported value is included in the weighted average as soon as the number of counts in the imported file exceeds the entry for the parameter **Minimum accepted counts**.
4. Click **Export**. The interference table file is created. To display the exported interference table, use a text editor to open the .txt file.

Fields on Window "Interference table export"

File name	Name of the export file, existing or new.
Weights settings - see also Weight Settings on page 15-25	
Absolute interfered area	Weight for the area experiencing absolute interference
Relative interfered area	Weight for the area experiencing relative interference
Absolute interfered traffic	Weight for the traffic experiencing absolute interference
Relative interfered traffic	Weight for the traffic experiencing relative interference
Imported interfered traffic	Weight for the imported traffic experiencing interference
Normalize interference table	Indicates that the values in the interference table should be normalized
Remove OL cells	Overlaid subcells are removed during export
Export	Starts the export to file

Example of Exported Interference Table

The following example shows part of an exported interference table:

Serving-cell Interfering-cell Co-channel Adjacent-channel

R00001A R00001C 14.079328 0.0011535903

R00001A R00001E 15.851452 0.0010614311

R00001A R00002A 0.7932507 4.1448566E-5

R00001A R00002E 0.0074585876 9.374908E-11

R00001A R00003A 0.05377163 3.749962E-10

R00001A R00003C 16.446348 0.0015934409

R00001A R00003E 7.8223257 4.7072882E-4

R00001A R00004A 0.055023696 4.4617616E-9

R00001A R00004C 0.61391264 7.3592695E-5

R00001C R00001A 14.924027 0.0011165242

R00001C R00001E 12.93202 6.480237E-4

R00001C R00002A 19.8931 0.0012304281

R00001C R00002C 0.0577824 6.163975E-10

R00001C R00002E 16.519905 6.813004E-4

R00001E R00001A 17.5715 0.0010591488

R00001E R00001C 18.077362 0.0010789437

R00001E R00002A 2.9822733 3.7769554E-5

R00001E R00002C 3.7987187E-4 7.559075E-12

R00001E R00002E 13.210495 6.864686E-4

R00001E R00004A 0.0029147384 1.511815E-11

R00001E R00004C 2.5031884 2.8977284E-4

R00001E R00004E 0.006094769 3.02363E-11

R00002A R00001A 2.2714643 7.203444E-5

Import and Export of OSS-RC GSM Network Data

You can import GSM network data in CNAI file format from Ericsson OSS-RC, expand, tune or optimize it in TEMS CellPlanner, and export it back to OSS-RC.

See instructions in *OSS-RC GSM Network Data* sections in chapters *Importing Data* and *Exporting Data* in the *TEMS CellPlanner Common Features User's Guide*.

You can also import ICDM files exported from OSS-RC to, see Import Interference Tables on page 13-4.

Import and Export of CellOpt AFP Data

As an alternative to using the TEMS CellPlanner AFP, you may export TEMS CellPlanner generated GSM frequency plans for optimization in CellOpt AFP version 3.0, and import the optimized result back into TEMS CellPlanner.

Export Frequency Plan to CellOpt AFP XML File

Use this procedure to export a GSM frequency plan to a CellOpt AFP XML file. The exported file is compatible with CellOpt AFP version 3.0.

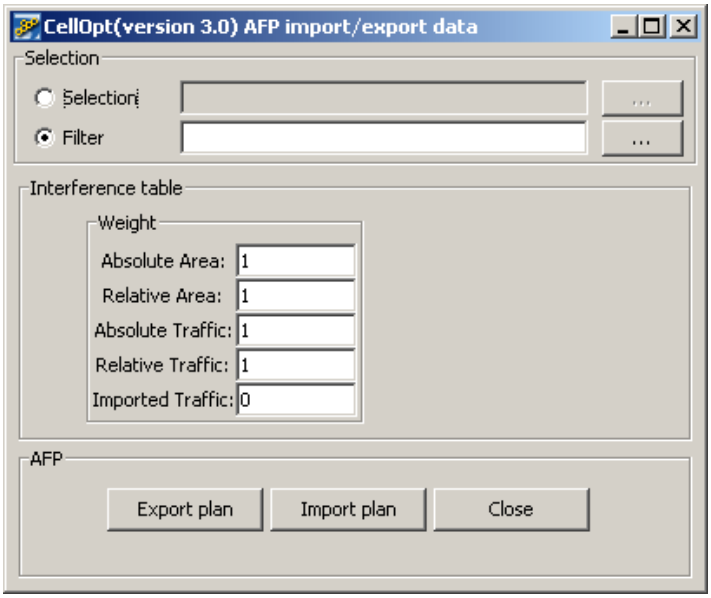
Prerequisites

- Frequency planning of the GSM project has been performed, see Frequency Planning in TEMS CellPlanner on page 18-2.
- Interference table calculation results are available, see Calculate and/or Import Interference Tables on page 15-26.

Procedure

Do as follows to export a frequency plan to an XML file readable by CellOpt AFP:

1. Select **Analysis↗GSM↗Import/export CellOpt AFP data...** The **CellOpt (version 3.0) AFP import/export data** window is displayed.



2. Enter the area and traffic weight factors, ranging from 0 to 1.
3. Click **Export plan**. The **Export of TCPU's frequency plan** window appears.
4. Enter a file name for the export and click **OK**. An XML file with the exported frequency plan is created.

The XML file may now be imported by CellOpt AFP version 3.0.

Fields on Window "CellOpt (ver 3.0) AFP import/export data"

Interference table	Used only for export to CellOpt. Weights: • Absolute area • Relative area • Absolute traffic • Relative traffic • Imported traffic See also About Interference Tables on page 15-24 and Export Interference Tables on page 13-4.
Export plan	Exports a frequency plan to a CellOpt AFP XML file.
Import plan	Imports a frequency plan from a CellOpt AFP XML file.

Import Frequency Plan from CellOpt AFP XML File

Use this procedure to import an optimized frequency plan generated by CellOpt AFP file version 3.0 can be imported.

Prerequisites

- The same GSM project as used for Export Frequency Plan to CellOpt AFP XML File is loaded.
- An optimized frequency plan exported to XML by CellOpt AFP version 3.0 is available.

Procedure

Follow these steps to import a frequency plan from a CellOpt AFP XML file:

1. Select **Analysis↗GSM↗Import/export CellOpt AFP data...** The **CellOpt (version 3.0) AFP import/export data** window is displayed. See Fields on Window "CellOpt (ver 3.0) AFP import/export data" on page 13-8.
2. Click **Import plan**. The **Import of CellOpt data frequency plan** window appears.
3. Select a CellOpt AFP XML file and click **OK**. The frequency plan is imported.

Import and Export of Other Data

In addition to GSM specific data, you can also import/export the following data to/from a GSM project:

- TCP XML, project in XML format for cross-version compatibility

  Tip: Try a demo project delivered in XML format together with this software. See *Use a Demo Project* in the *TEMS CellPlanner Common Features User's Guide*.

- EET/Planet 2.x antennas (import only)
- Generic text file
- Attribute text file
- Generic map file (import only)
- Live traffic text file (import only)

For detailed information, refer to *Importing Data* and *Exporting Data* in the *TEMS CellPlanner Common Features User's Guide*.

14
Pathloss

Pathloss calculations predict the expected coverage of a network plan. Pathloss calculations are a prerequisite for further network analysis, as described in chapter GSM Analysis on page 15-1.

Chapter *Calculating Pathloss* in the *TEMS CellPlanner Common Features User's Guide* describes how to calculate the pathloss.

15
GSM Analysis

This chapter describes how to analyze the performance and coverage of a GSM network plan.

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About GSM Analysis

When you have performed a pathloss calculation, you can analyze your GSM network plan in different ways. The first step is to run the Best Server Analysis. Then you can go on with Interference Tables, Traffic Performance Analysis and Neighbor Analysis. Neighbors can be considered along with an interference table in the AFP for Fixed Frequency or Baseband Hopping, BSIC Optimization and HSN Optimization.

About Traffic Cases

A *traffic case* is a combination of a terminal type and a GSM bearer. Only the combinations defined when you create the terminals may be used as traffic cases.

TEMS CellPlanner can produce coverage and best server plots for each traffic case. Traffic distribution is not required for this analysis.

When calculating the best server, you select one or more traffic cases from a list containing all terminals associated with the GSM bearers that they support. Only the selected traffic cases are valid for the other analysis functions.

After you have calculated the best server, you can display the list of analysis results. For each traffic case, a number of coverage and best server plots are available.

Traffic Cases and Traffic Performance

TEMS CellPlanner calculates a number of parameters related to the traffic per cell for each traffic case, or for a combination of traffic cases. A traffic demand mix can be used to define the traffic density.

When you start the **Calculate traffic performance** function, you can select one or more traffic cases to include in the analysis, and either cell data or a traffic demand mix as the traffic source.

Traffic Source Data

If you use cell data as the traffic source for analysis, the traffic amounts set in the cell data are used to calculate all other traffic parameters for all selected traffic cases.

If you use a traffic demand mix as the traffic source for analysis, the mix must contain a traffic demand for each GSM bearer included in each selected traffic case. You can increase or decrease the amount of traffic generated for each traffic demand by changing its scale factor. The total amount of traffic in each cell is calculated as the sum of the traffic for all selected traffic cases.

You must select a traffic demand mix containing a traffic demand for each selected traffic case. If the traffic demand mix does not contain any traffic demand for one of the selected traffic cases, the traffic is set to zero for this traffic case when the total traffic is calculated.

Traffic Cases and Packet Switched Analysis

If you perform packet switched analysis for GPRS and EGPRS traffic, you must define more parameters.

After calculating traffic performance, you can display the list of analysis results. Several traffic performance plots are available for each selected traffic case.

Traffic Cases and Interference Tables

TEMS CellPlanner can calculate interference tables for each traffic case, or for a combination of traffic cases. The tables contain the co-channel and adjacent channel interfered area and traffic for every combination of a serving cell and an interferer. A traffic demand mix is used to calculate the interfered traffic.

When you calculate interference tables, TEMS CellPlanner displays a list of the valid traffic cases that were selected for calculating best server. For each traffic case, you set weight factors for the interfered area calculation and the interfered traffic calculation.

Interfered Areas and Traffic

The interfered area in a serving cell caused by an interfering cell is calculated as the weighted average of the interfered areas for all included traffic cases.

Interfered traffic in a serving cell is calculated as the weighted average of the interfered traffic, provided that a valid traffic density exists for each traffic case.

You must select a traffic demand mix containing a traffic demand for each selected traffic case. If a traffic demand mix does not contain any traffic demand for one of the selected traffic cases, the interfered traffic is set to zero for the traffic case when the weighted average is calculated.

Importing Interference Tables

You can import an interference table from the mobile network. You can use the imported values in the exported table. The parameter *Minimum acceptable count* controls whether the imported or calculated values are used.

Displaying Interference Tables

After you calculate or import an interference table, the contents are displayed in the map window. Using the Best Server plot for a selected traffic case, you can display the interference table using the Interference cursor. When you click an interfered cell, the Best Server area of the cell is colored black, and all interfering cells are displayed in a dark color. You can control-click an interfering cell to display the interference table contents for the selected cell pair.

For every pair of interfered cell and interferer, the interference table contains parameters for absolute and relative adjacent and co-channel interfered area and traffic, plus imported adjacent and co-channel interfered traffic.

Exporting Interference Tables

You can export interference tables. The exported table contains two parameters for every pair of interfered cell and interferer: a co-channel interference and an adjacent channel interference value. Each parameter is calculated as a weighted average of the interfered area and traffic values.

You set weight factors in the exported interference table for absolute and relative area and traffic, plus imported traffic. If you set the first four weight factors to the same value, the parameter with the largest values (for example absolute interfered traffic) dominates the weighted average. When you set the last factor to a positive value, the imported value is included in the weighted average when the number of counts in the imported file exceeds the number defined by the parameter *Minimum acceptable counts*.

Traffic Cases and Neighbor List Optimization

TEMS CellPlanner calculates a list of neighbors to all cells included in a selected traffic case, where possible neighbors are selected by the same or another traffic case. No traffic distribution is needed for this analysis.

When you start neighbor list optimization, you specify the set of original cells (the cells from which the neighbor relations are calculated) by selecting a traffic case. For inter-technology neighbors (GSM to WCDMA or vice versa) you specify the set of potential neighbor cells by selecting another traffic case.

After neighbor list optimization, you may view the neighbors on the map display.

Traffic Cases and Calculating Interference Data

TEMS CellPlanner can calculate different interference parameters for every bin in a given best server plot. The interference caused by a cell on a traffic carrier is proportional to the cell's traffic load factor, given in the cell data. The load factor may be applied to each cell manually, or may be taken from the calculation results of calculating traffic performance.

When you calculate interference data, you must select a traffic case to define the best server plot used for the interference analysis.

After the analysis is performed, you can display the list of analysis results. The selected interference analysis plots are available for the selected traffic case.

Analyze a GSM Network for EDGE Evolution - Example

Do as follows to enable cells and terminals for EDGE Evolution and analyze coverage and performance for the network plan:

1. Open the System explorer, create a GSM bearer and choose bearer type EDGE Evolution.
2. Open the Equipment explorer, create a GSM terminal with one Rx antenna and another GSM terminal with two Rx antennas, and add the EDGE Evolution bearer to their supported bearers.
3. Open the GSM RBS explorer, select and open a number of RBSs, then select and open all their cells and enable them for GPRS (if not done before).
4. Open all channel groups contained in the cells, define some TSs as EDGE enabled (if not done before) and enables EDGE Evolution in all the channel groups.
5. In the System explorer, create a traffic demand mix containing the two traffic cases:
   - EDGE Evolution bearer + terminal with one Rx antenna
   - EDGE Evolution bearer + terminal with two Rx antennas
6. Run the GSM best server analysis for the two traffic cases.
7. Run the GSM interference data analysis for the two traffic cases to generate average connection plots.
8. Open the GSM traffic analysis window and start the analysis.
9. View plots with results from the GSM traffic analysis.

Best Server Analysis

Best Server calculations are used extensively by all other analysis functions in TEMS CellPlanner. You must always calculate best server before starting any other analysis.

Usually the GSM best server cell is the cell with the highest signal strength in each bin, but when HCS is used, the GSM best server cell is the first cell in the sorted hierarchical cell structure (HCS) ranking list. The plot displays details about the best serving cell at each bin. Best server calculations are not based on frequency assignments or interference calculations.

Sub-Cells Considered in Calculations

If you use overlaid and underlaid sub-cells, both the layers of sub-cells are considered in the calculations.

Overlaid/Underlaid Cells

When you define overlaid and underlaid sub-cells, they are used in calculating all results. When a cell consists of underlaid and overlaid cells, the parameters for the cell apply to the underlaid cell, and a different set of parameters is used for the overlaid cell.

The best server displays show the set of sub-cells defined in a selected traffic case. This set contains the sub-cells selected by a site filter serving a specified traffic case, that is, a terminal type and a bearer. The displays are different for each traffic case. The bins served by the overlaid sub-cell of the best server are indicated with signal strength of the overlaid sub-cell.

A sub-cell must match the following criteria to be included as a best server:

- Belong to a site enabled by the selected site filter.
- Belong to the frequency band used by the selected bearer.
- Support GPRS if the selected bearer uses GPRS
- Support GPRS and have at least one timeslot configured for EGPRS, if the selected bearer uses EGPRS.
- Have prediction data.

The best server area of the UL sub-cell is determined from the coverage prediction for the underlaid sub-cell. Then the best server area of the overlaid sub-cell is determined, applying maximum pathloss and timing advance limits with the coverage prediction for the overlaid sub-cell.

Dual-Band (Multi-Band) Cell Support

It is possible to define dual-band cells with overlaid and underlaid sub-cells using different GSM frequency bands. Each sub-cell must have its own antenna branch with a propagation model and an antenna supporting the frequency band.

Print Analysis Results

Each display generated by analysis functions can be sent to a printer or plotter.

Calculate GSM Best Server

Calculating best server generates displays showing the best server in a GSM network plan. Calculations for best server are based on:

- Signal strength
- Timing advance
- Hierarchical cell structure (HCS) parameters

Memory Allocation for Displaying Plots

To display best server plots, you must be sure that you allocate enough computer memory for TEMS CellPlanner. See "Allocate Memory for Displaying Plots" in the chapter "Setting Up Projects" in the *TEMS CellPlanner Common Features User's Guide*.

Restrict Sites with Filters

You may restrict included sites by using a site filter.

Prerequisites

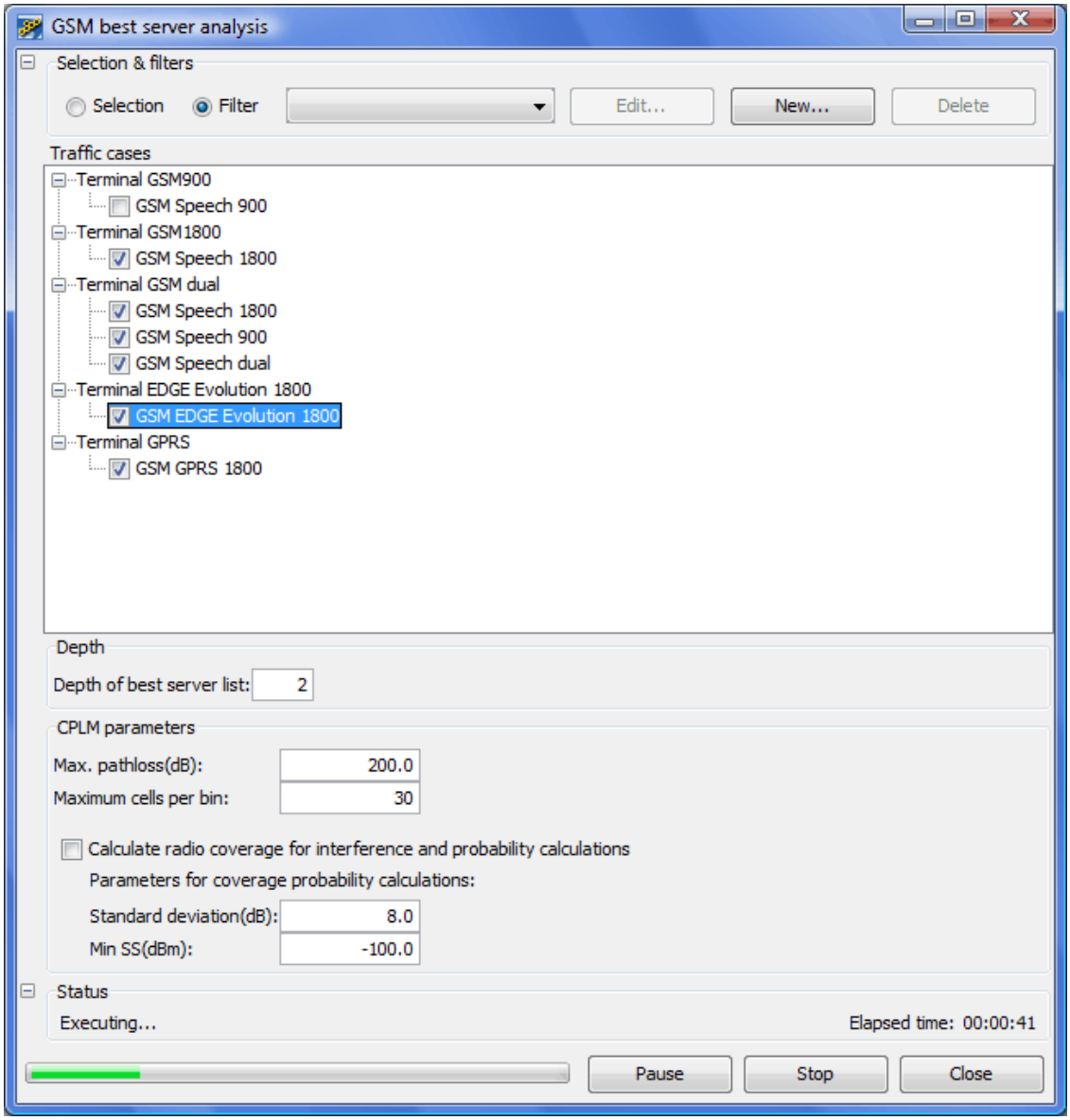
Before generating best server displays:

- Data for the base station sites and cells must include at least one HCS layer and one HCS band for the BSC controlling the base stations.
- You must define at least one traffic case. A traffic case consists of a terminal associated at least one bearer.
- You must calculate pathloss, including the azimuth- and tilt-dependent base station antenna gain, using a propagation model selected for every cell. The pathloss must be predicted from the site to all bins within a specified distance from the cell.
- For compatibility with Ericsson BSS releases before R8 and equipment from vendors other than Ericsson, you can set a signal strength offset for every cell.

Procedure

Follow these steps to calculate best server:

1. Select **Analysis↗GSM↗Calculate best server** to display the **GSM Best server analysis** window.



2. Select the traffic cases to analyze.
3. Optionally modify CPLM parameters and parameters for interference and coverage probability calculations.
4. Click **Start** to begin the calculation.

Fields on Window "GSM best server analysis"

Traffic cases	Traffic cases contain a combination of site filter, terminal type, and bearer. The traffic case defines the set of cells to include in the calculation.
Depth of best server list	Determines the number of plots to generate, which for every bin on the map shows the identity or signal strength of the first, second, and third ranked cell that may serve a terminal located in the bin. Range = 1 - 6. Initial = 2.
CPLM parameters	
Max. pathloss (dB)	Maximum pathloss in dB to consider in the calculations.
Maximum cells per bin	Maximum number of cells from which the pathloss values are calculated in one bin.
Interference and coverage probability parameters	
	• Calculate radio coverage for interference and probability calculations - option to calculate unfiltered radio coverage to be used when calculating interference data. Initially unselected. • Standard deviation (dB) - log normal fading standard deviation. Range: 3 - 20. Initial = 8 dB. • Min SS (dBm) - minimum required signal strength. Range: -200 - 100. Initial = -100 dBm

Display GSM Best Server Results

For the selected bearer, the system generates Best Server results for all bins with calculated signal strength predictions. You can save the result plots to files. For every bin, the results contain:

- Best Server identity
- Predicted signal strength of the Best Server

For generic information about plots, read chapter *Plots* in the *TEMS CellPlanner Common Features User's Guide.*

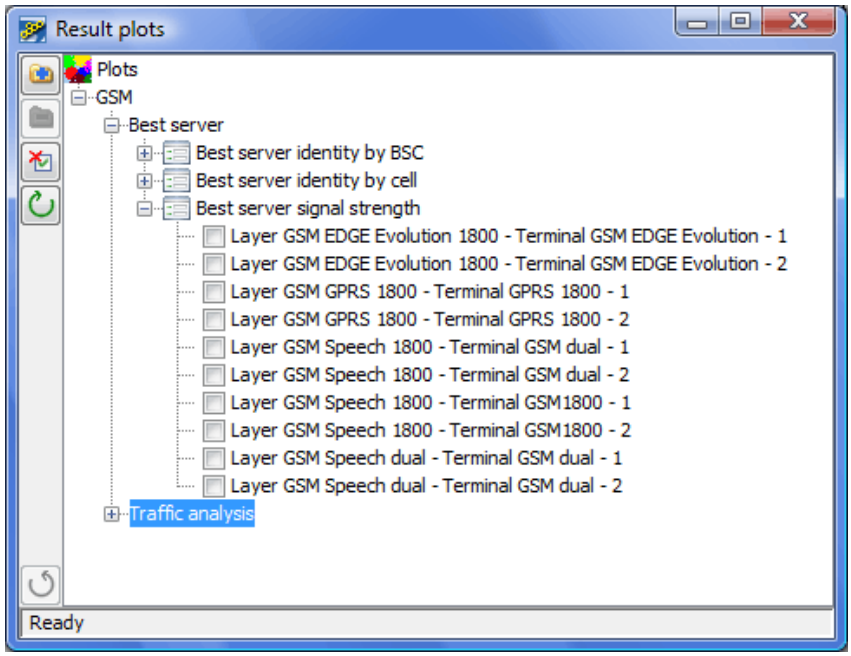
Prerequisites

Before generating Best Server plots, be sure to allocate enough computer memory to display the plots. See the *TEMS CellPlanner Common Features User's Guide,* section *Setting Up Projects* chapter for further information.

Procedure

Follow these steps to generate and display best server plots:

1. Select **Analysis↗Result plots**. The **Result plots** window appears.


Result plots
Plots
GSM
Best server
Best server identity by BSC
Best server identity by cell
Best server signal strength
Layer GSM EDGE Evolution 1800 - Terminal GSM EDGE Evolution - 1
Layer GSM EDGE Evolution 1800 - Terminal GSM EDGE Evolution - 2
Layer GSM GPRS 1800 - Terminal GPRS 1800 - 1
Layer GSM GPRS 1800 - Terminal GPRS 1800 - 2
Layer GSM Speech 1800 - Terminal GSM dual - 1
Layer GSM Speech 1800 - Terminal GSM dual - 2
Layer GSM Speech 1800 - Terminal GSM1800 - 1
Layer GSM Speech 1800 - Terminal GSM1800 - 2
Layer GSM Speech dual - Terminal GSM dual - 1
Layer GSM Speech dual - Terminal GSM dual - 2
Traffic analysis
Ready

2. Select the traffic case(s) for which to display a certain plot. The selected plots appear on the map display.

Fields on Window "Result plots"

(result plots tree)	Organized by type of mobile technology. GSM best server plots are located under GSM traffic cases.
OK	Creates plot selected from the list and closes the window
Cancel	Cancels plot creation and closes the window
Apply	Creates the plot selected from the list

Results Available

TEMS CellPlanner generates results for every bin shown in the map window. Each color in the display defaults to pre-set signal strength threshold values. You can define new threshold settings and redraw the plots using the new settings.

Display	Description
GSM Best server by BSC identity	A specific color indicates the identity of the BSC connected to the best server for the bin, using HCS ranking and overlaid/ underlaid sub-cell layers.

Display	Description
GSM Best server by cell identity	A specific color identifies the best server (serving cell) for the bin. The best server identity may be different for each traffic case, using HCS ranking and overlaid/underlaid sub-cells.
GSM Best Server (Composite)	A specific color indicates the received signal strength of the strongest signal from any cell supporting the selected bearer, using HCS ranking and overlaid/underlaid sub-cell layers.

Traffic Performance Analysis

Calculating traffic performance determines the traffic load on each cell and overlaid sub-cell. The traffic load is used to check the quality of service with the current number of TRXs in each cell, and to calculate the number of TRXs required to achieve a desired quality of service.

CS / PS Traffic in Cells

A GSM cell has attributes for the amount of circuit switched (CS) and packet switched (PS) traffic offered in the cell. They are located on the General tab of the GSM cell editor. Corresponding attributes for overlaid cells are located on the Overlaid sub-cell tab. There are separate attributes for GPRS, EGPRS, EDGE Evolution, and circuit switched traffic. The attributes define the amount of traffic in kbps and Erlang, respectively.

The traffic values obtained from the Traffic performance calculation are fed back to the cell attributes if the Apply traffic option is selected when running the analysis. Note that the attributes specify the amount of *offered* traffic. This is not always the same as the amount of *served* traffic, as some traffic might be blocked.

Note that the attributes are not used as input to the Traffic performance calculation, only as output. The input load is always defined with a traffic demand mix.

The traffic attributes can also be set by the Live traffic import function, or be defined manually in the GSM cell editor. Further, they are used as input to the Live traffic distribution function.

Load Factor in Cells

Together with the traffic attributes, there is also an attribute for the load factor, which describes the transmission probability for the cell. It depends on both the amount of traffic and the TRX capacity of the cell. This attribute is set by the Traffic performance calculation if the option Apply load factor is selected when running the analysis, and can also be set manually in the editor. It is not used as input to the traffic performance calculation, but is used to Calculate GSM Interference Data.

PS Traffic

The maximum achieved bit rate for PS traffic (GPRS, EPGRS or EDGE Evolution) depends on the carrier-to-interference ratio (C/I). If the network has PS traffic, use the results from calculating interference data and re-calculate traffic performance, repeating the calculation to update the bit rates and the dimensioning that depend on them.

Data Rate Calculations

For GPRS, there are four Coding Schemes, CS-1 to CS-4, giving different data rates. For each CS-n, the achieved data rate depends on the C/I.

For EGPRS, there are nine Modulation and Coding Schemes, MCS-1 to MCS-9, giving different data rates, depending on the C/I.

EDGE evolution uses even more MCSs. TEMS CellPlanner uses one mapping curve that gives the data rate for the optimal MCS at every C/I.

TEMS CellPlanner can calculate the best achievable data rate in every bin for packet traffic when the average connection C/I has been calculated. If an average connection C/I is not available, then C/I = 12 dB is used.

Throughput Calculation

TEMS CellPlanner uses a mathematical model for the dependence of achieved throughput (inclusive of queuing delay) on the total circuit switched and packet switched traffic load in the cell. The model is used to calculate and display the achieved throughput for a given number of transceivers and a given traffic load. The model is also used to calculate and display the number of transceivers (total or capable for EGPRS) that are required to achieve a sufficient throughput.

Process of Using GPRS/EGPRS in Projects

The following process outlines the tasks required to use GPRS and EGPRS services in a GSM network plan:

1. Create GSM bearers for GPRS, EGPRS and EDGE evolution.
2. Create terminals using the GPRS and EGPRS bearers.
3. If you will use coding schemes CS-3 and CS-4, select option GPRS CS3 and CS4.
4. In the Site Explorer, use the *Global edit* function to enable GPRS for all cells and overlaid sub-cells.
5. To enable EGPRS traffic in a cell, you must edit one of its channel groups and set the number of EGPRS timeslots to a positive value, for example 8. You can also enable a number of timeslots for GPRS with the two highest-rate Coding Schemes, CS-3 and CS-4. Also enable EDGE evolution in the channel groups.
6. Create traffic demand mixes for GPRS and EGPRS. These traffic demand mixes contain four traffic demands, the first with target name "Voice", the second with a target containing GPRS, the third with a target containing EGPRS, and the fourth with a target name containing EDGE evolution.
7. Set the terminal distributions for the four traffic demands so that the voice terminal is included in the first, a GPRS terminal in the second, an EGPRS terminal in the third, and an EDGE evolution terminal is included in the last traffic demand.

Calculate GSM Traffic Performance

Use this procedure to calculate traffic performance for a GSM network plan.

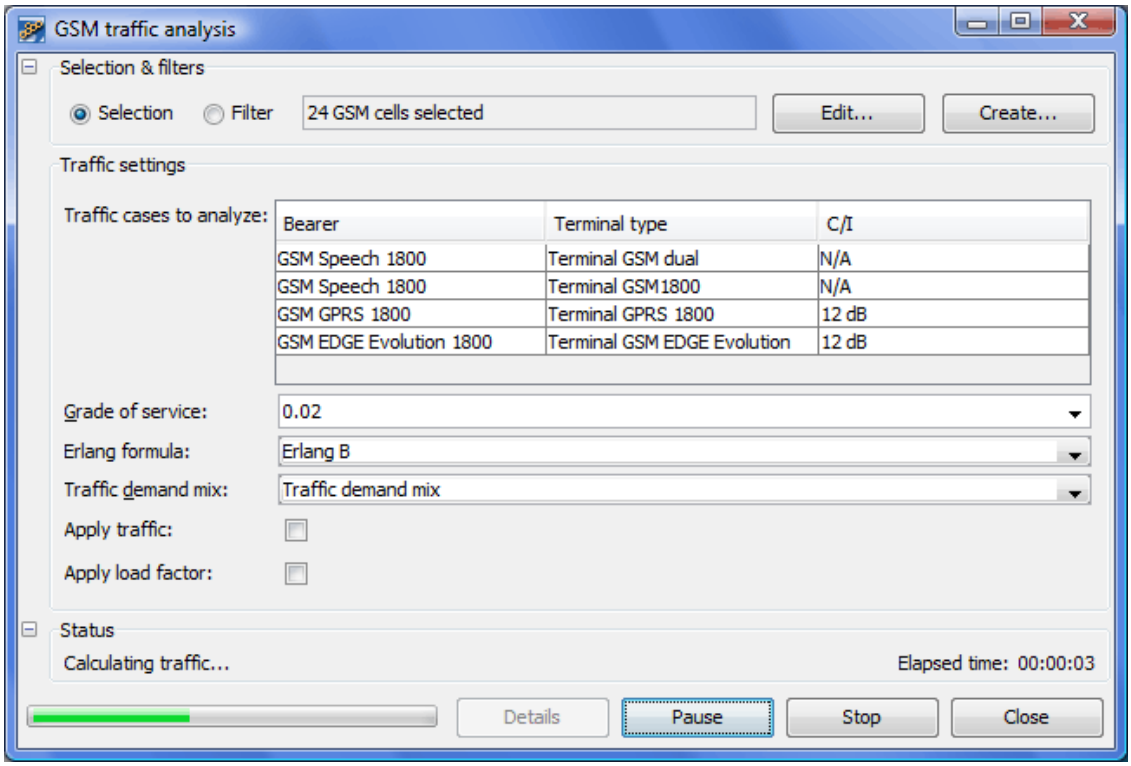
Procedure

Results from Best Server Analysis are available.

Procedure

Follow these steps to calculate GSM traffic performance:

1. Select **Analysis↗GSM↗Calculate traffic performance**. The **GSM traffic analysis** window appears.
2. Select a traffic demand mix. In this example a mix of speech and packet (GPRS and EDGE Evolution) traffic is selected.
3. If you perform a C/I calculation, the average interference raster will be used to calculate the bitrates per packet service type (in this example GPRS and EDGE Evolution), else C/I = 12 dB is used.
4. Click **Start** to calculate the traffic performance.



Fields on Window "GSM traffic analysis"

Traffic cases to analyze	The name of the bearer and of the terminal for each traffic case to use in the analysis
Grade of Service	Target blocking rate for voice calls. For example, a value of 0.02 means 2% of the calls shall be blocked. Grade of Service (GOS) to use for calculating traffic performance. You specify GOS in the System explorer. Selectable values: • 0.010 • 0.015 • 0.020 • 0.025 • 0.030
Erlang formula	Selects the Erlang formula to use in the analysis, required to calculate the number of transceivers needed. Options include: • Erlang B • Erlang C
Traffic demand mix	Mandatory selection from list of traffic demand mixes. The traffic demand mix defines the traffic used in calculations.
Apply traffic	If this option is selected, calculated traffic values will be fed back to the cell's traffic attribute values.
Apply load factor	See Load Factor in Cells on page 15-13.

Change Traffic Load Factors

The traffic load determined by calculating traffic performance is needed in calculating interference data, since interference on the TCH carriers caused by a cell is proportional to the traffic load on the cell. You should calculate traffic performance before calculating interference data.

When you calculate traffic performance, the traffic load factor is set for every cell and overlaid sub-cell. You may want to change the traffic load factors, for example to set the load factors equal to 1.0 to simulate a worst case possibility.

Procedure

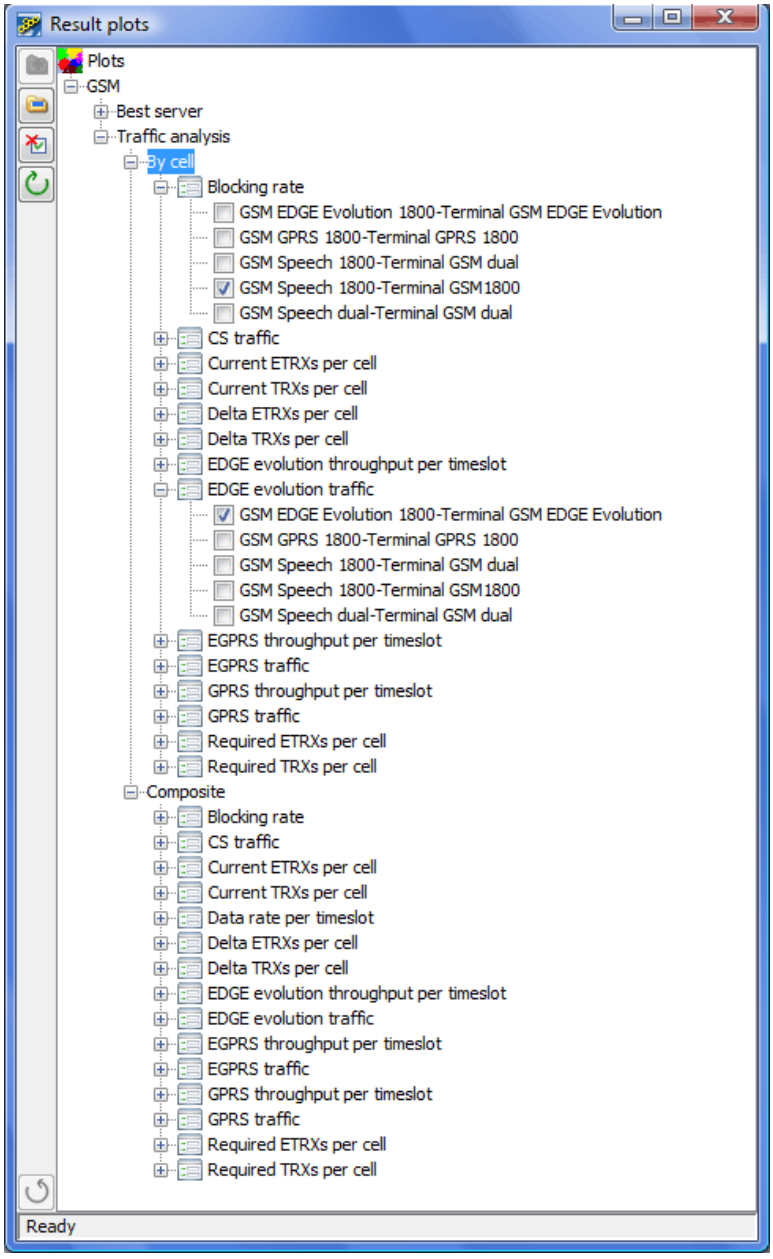
Do as follows to change the load factors for cells, using the global edit function:

1. In the Site explorer, open the desired cells or overlaid sub-cells.
2. Use the global edit function to select cells to edit globally: select the first cell, and **Shift-click** the last cell.
3. Enter the desired load factor value, and click **Apply**.

Display GSM Traffic Analysis Plots

For generic information about plots, read chapter *Plots* in the *TEMS CellPlanner Common Features User's Guide*.

The Traffic Performance Plots selectable from **Analysis↗Result plots** are as follows:



Plotted values can be extracted and written to a statistical report, see the *TEMS CellPlanner Common Features User's Guide*.

TCH Timeslots

All data rate calculations are performed for one TCH timeslot. Terminals capable to use several timeslots can achieve data rates proportional to the number of timeslots.

Overlaid Sub-Cells

When you use overlaid sub-cells, all values are calculated and displayed for the required number of TRXs. The traffic of the overlaid sub-cell is added to the traffic of the underlaid sub-cell, and the required number of TRXs is calculated for the joint cell. The required number of TRXs for the underlaid sub-cell is calculated, and finally the required number of TRXs for the overlaid sub-cell is found by subtraction.

The blocking rate is calculated separately for the overlaid and underlaid sub-cell, but if the blocking rate in an overlaid sub-cell would become higher than the blocking rate in the underlaid sub-cell, traffic can overflow to the underlaid sub-cell so that the blocking rate becomes equal for both sub-cells.

Distribute Live Traffic

When tuning an existing network, it is convenient to use live traffic measurements per cell from the BSC, instead of estimating the traffic theoretically. The use of live traffic distribution in TEMS CellPlanner helps you find out how an increased traffic load in some cells would affect the network.

You can spread the traffic of a cell over its best server area either uniformly or weighted according to land use codes.

Use this procedure to distribute live traffic for a GSM network plan. The output of the live traffic distribution is a float raster that you can display in the main window.

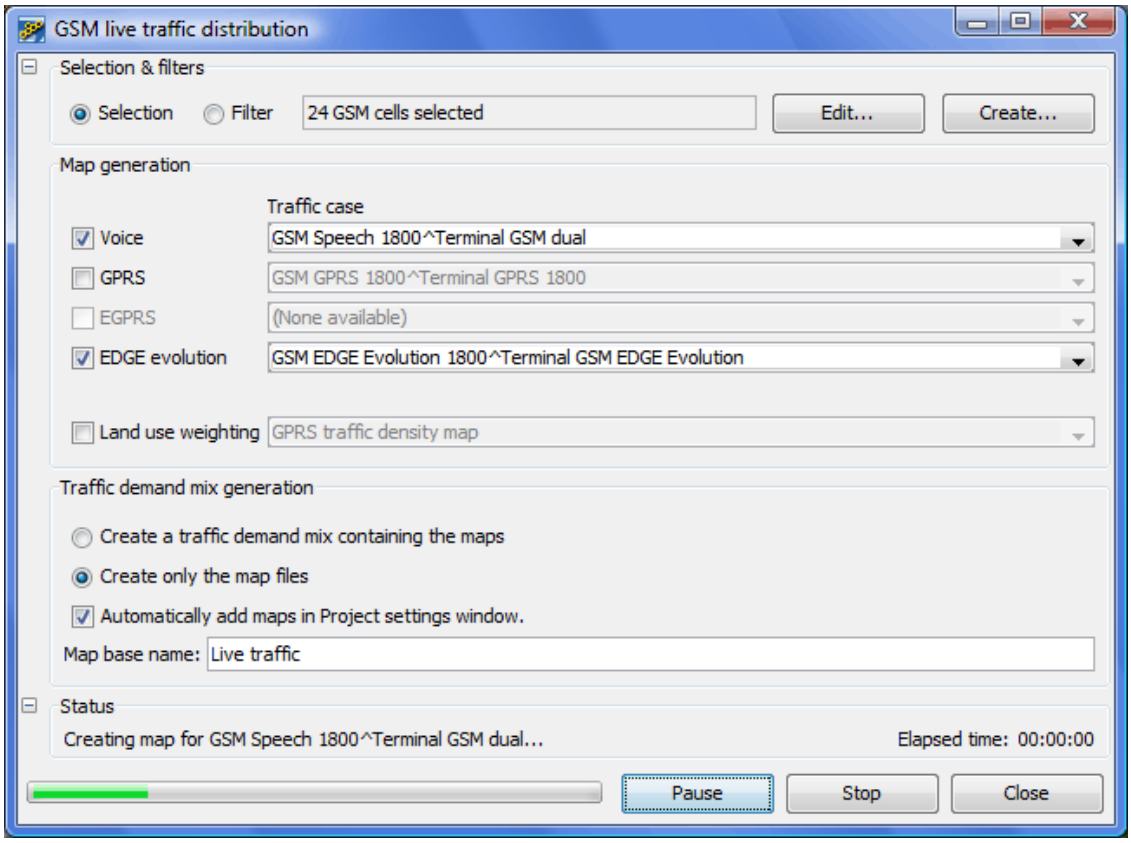
Prerequisites

If required, import live traffic data into the project, using **Import↗Live traffic**.

Procedure

Follow these steps to distribute live traffic in a GSM network plan:

1. Select **Analysis↗GSM↗Distribute live traffic**. The **GSM live traffic distribution** window is displayed.



2. Select options for service types to include: Voice, GPRS, EGPRS and/or EDGE evolution, and select per service type the desired **Traffic case**.
3. Set other parameters as desired, see Fields on Window "GSM live traffic distribution" on page 15-20.
4. Click **Start**. The raster map file(s) and optional traffic demand mixes are generated. The distributed live traffic is stored as color marks in a map layer.

Fields on Window "GSM live traffic distribution"

Map generation	
Voice	Distributes live voice traffic.
GPRS	Distributes live GPRS traffic.
EGPRS	Distributes live EGPRS traffic.
EDGE Evolution	Distributes live EDGE Evolution traffic.
Land use weighting	When selected, displays a list of existing traffic density maps to use for land use weighting
Traffic demand mix generation	
Create a traffic demand mix containing the maps	Create both the live traffic distribution map files and a traffic demand mix containing those maps
Create only the map files	Creates live traffic distribution map files, but no traffic demand mix
Automatically add maps in Project settings window	Add maps to list of maps for the project in the **Project settings** window. Also adds maps to the list of available map layers to add in the **Map properties** window.
Map base name	Name the traffic demand mix and the map being created. If only map files will be created, enter the base name of the map files. Maximum 128 alphabetical or numerical characters. Do not use /,\,' or %.

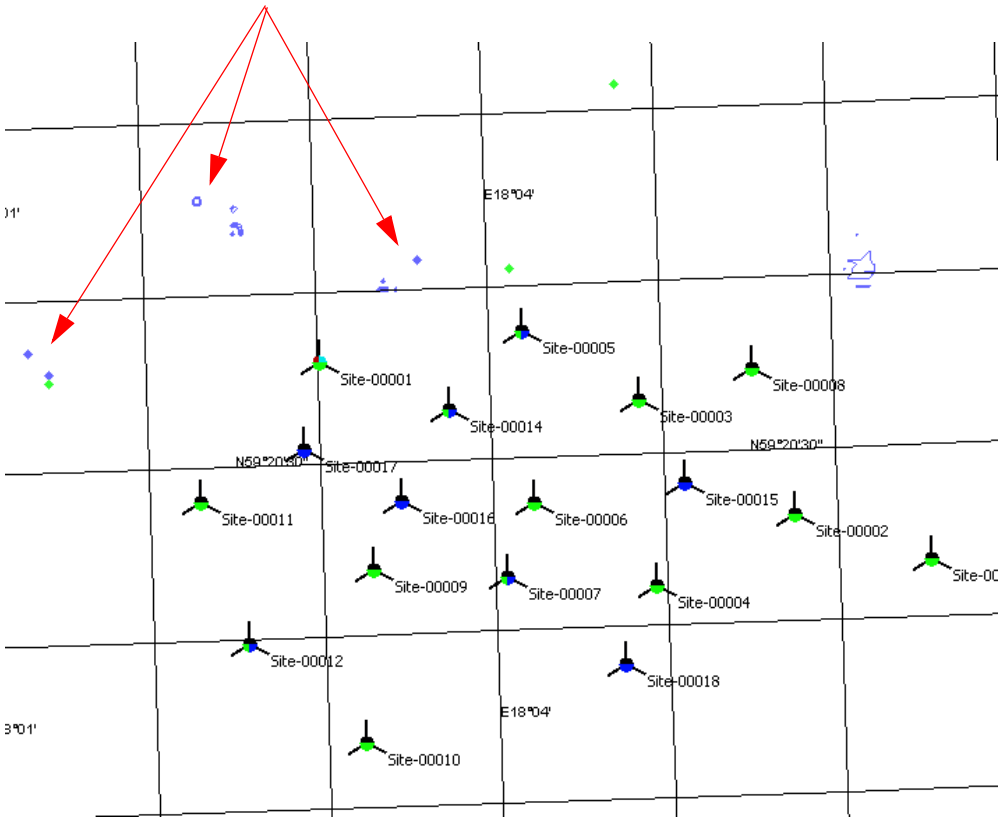
View Distributed Traffic

After Distribute Live Traffic on page 15-19 you may view the results on the map display. Select the new map layer in the **Map properties** window. You can change the default name of "Float Raster" to any name you wish.

See *Add Map Layers for Display* in the *TEMS CellPlanner Common Features User's Guide*.

The distributed traffic might look as in the following example:

Live traffic distributed on map display



Apply TRXs

The Traffic Performance Analysis calculates, for each cell, the number of TRXs required to achieve a specified maximum blocking rate (Grade of Service) for voice, and a specified minimum desired throughput for packet data services. The result is a list of suggested changes of the number of TRXs.

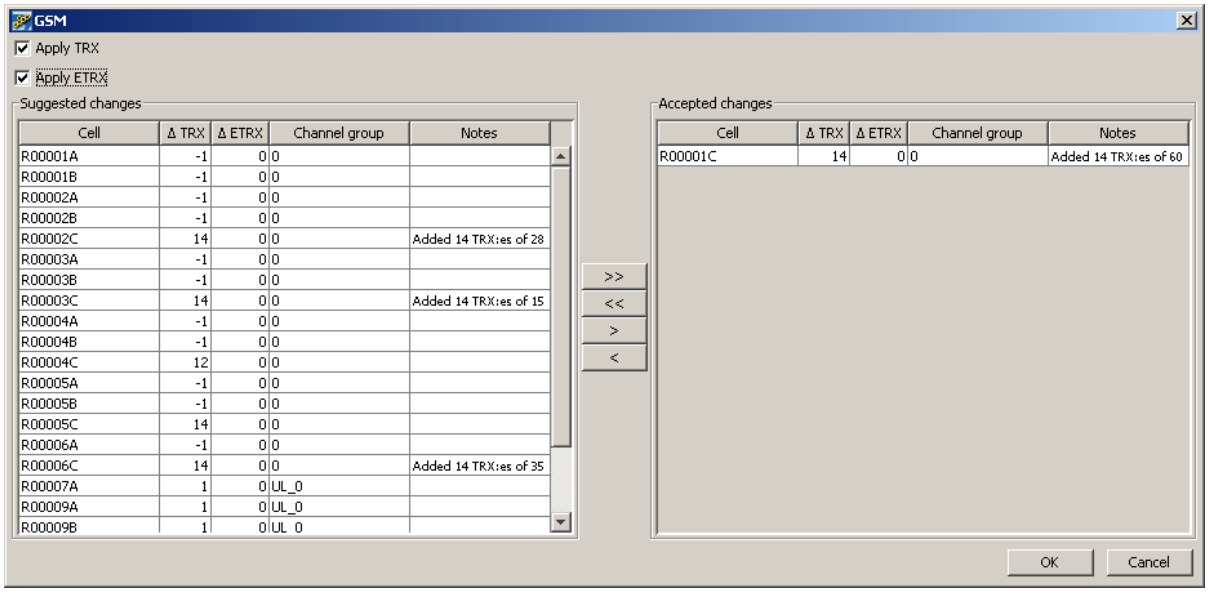
Use this procedure to select which of the suggested changes to apply to your network plan.

Prerequisites

Suggested changes of number of TRXs are available from Traffic Performance Analysis.

Procedure

1. Select **Analysis↗GSM↗Apply TRXs**. The **Apply TRXs** window is displayed.


GSM
Apply TRX
Apply ETRX
Suggested changes
Cell | Δ TRX | Δ ETRX | Channel group | Notes
R00001A -1 0 0
R00001B -1 0 0
R00002A -1 0 0
R00002B -1 0 0
R00002C 14 0 0 Added 14 TRX:es of 28
R00003A -1 0 0
R00003B -1 0 0
R00003C 14 0 0 Added 14 TRX:es of 15
R00004A -1 0 0
R00004B -1 0 0
R00004C 12 0 0
R00005A -1 0 0
R00005B -1 0 0
R00005C 14 0 0
R00006A -1 0 0
R00006C 14 0 0 Added 14 TRX:es of 35
R00007A 1 0 UL_0
R00009A 1 0 UL_0
R00009B 1 0 UL_0
>>
<<
>
<
Accepted changes
Cell | Δ TRX | Δ ETRX | Channel group | Notes
R00001C 14 0 0 Added 14 TRX:es of 60
OK
Cancel

2. Select **Apply TRX** and/or **Apply ETRX** according to which type of TRXs you want to apply.
3. In the **Suggested changes** list, select the changes to accept and move them to the **Accepted changes** list. Click **>>** to select all changes, or **>** to select specific changes. Click **<<** to deselect all changes, or **<** to deselect specific changes.
4. Click **Apply**.

Note: *A new frequency plan is needed after the changes have been applied.*

Fields on Window "Apply TRXs"

Apply TRX	If enabled, the accepted TRX changes will be applied.
Apply ETRX	If enabled, the accepted ETRX changes will be applied.
Suggested changes	The (E)TRX additions or removals suggested by the traffic performance calculations. • Cell - The cell identity • Δ TRX - Number of TRXs to add or remove • Δ ETRX - Number of ETRXs to add or remove • Channel group - The channel group hosting the (E)TRXs • Notes - Comment added by TEMS CellPlanner. Example: `Added 14 TRXs of 35.`
Accepted changes	The suggested (E)TRX additions or removals accepted by the user. The parameters are the same as in the list of Suggested changes.

Interference Tables

The interference between cell pairs is essential information for Automatic Frequency Planning (AFP) and for your quality check of the network plan when you Display Interference Tables. The information is stored in *interference tables*.

You can calculate predicted values for interference tables based on algorithms, or import measured values from an ICDM file, or calculate and import values at the same time. How to do is described in Calculate and/or Import Interference Tables.

About Interference Tables

For every cell, the interference situation is different depending on the type of traffic that is served. In a network where a small subset of the cells support EGPRS, the EGRS traffic of a given cell is likely to see more interference than the voice traffic of the same cell, since the coverage area of the cell is larger for EGPRS than for voice.

TEMS CellPlanner calculates an interference table for each traffic case, or combination of traffic cases. The table contains the co-channel and adjacent channel interfered area and traffic for every combination of a serving cell and an interferer, using a traffic demand mix to calculate interfered traffic.

It is possible to use more than one traffic case as input when calculating the interference table, and weight settings are defined for the different traffic cases to specify their relative importance when the interference values for the individual traffic cases are aggregated.

When you start interference table calculation, TEMS CellPlanner displays a list of the valid traffic cases, previously selected for Best Server analysis. For each traffic case, you set weight factors for the interfered area calculation and for the interfered traffic calculation.

Interference Table Contents

An interference table contains the information below per cell pair. You can see this information when you Display Interference Tables per cell (distinguishing between co-channel and adjacent channel interference). These are also the parameters to put weights on when you Calculate and/or Import Interference Tables, Export Interference Tables or perform Automatic Frequency Planning (AFP).

Information from Interference Table	Description
Absolute interfered area	Number of km^2 of interfered area
Relative interfered area	% of interfered area in relation to the cell area
Absolute interfered traffic	Amount of traffic experiencing interference, expressed in number of Erlangs

Information from Interference Table	Description
Relative interfered traffic	% of traffic experiencing interference in relation to all traffic in the cell
Imported traffic	Number of interfered calls per busy hour

ICDM

Inter Cell Dependency Matrix (ICDM) files contains measured interference values per cell pair in a live network. ICDM files can be exported from some operations and maintenance system, for example Ericsson OSS-RC.

Weight Settings

The weight settings allow you to compare "apples and oranges", or strictly speaking to weight interference over a certain area with interference on a certain amount of traffic.

Note that the weight factors you enter are dimensionless; they just scale the importance of the interference information.

When you use interference tables as input to Automatic Frequency Planning (AFP), or when you Export Interference Tables, you can normalize the various interference values by selecting option **Normalize interference table.** All values of the same type, for example Absolute interfered area, are then divided with the maximum value (the interference value of the most interfered cell) before weighting, and are then transformed to a value in the range 0..1. By normalizing the values you avoid that entities with high numerical values get unproportional high impact.

As an example, 3 km^2 of interfered area is probably more severe than 4 Erlangs of interfered traffic. Normalize the values, and define a higher weight for interfered area. The values will first be normalized, then the weighting is applied, which means that you can compare 1 km^2 with 1 Erlang from an interference point of view.

In a second example, you consider 1 km^2 of predicted interfered area as being of equal importance as 5% of measured interfered traffic. You should then set the parameters as follows:

```
Absolute interfered area = 5
Relative interfered area = 0
Absolute interfered traffic = 0
Relative interfered traffic = 0
Imported interfered traffic = 1
Normalize interference table = selected
```

These settings result in that the interfered area is normalized to a value in range 0..1 and then multiplied with 5. Interfered traffic is also normalized to 0..1 and then multiplied with 1. The cell with the highest interfered area gets value 1 after normalization.

Calculate and/or Import Interference Tables

Use this procedure to create interference tables per traffic case. The interference tables are filled with predicted interference from algorithms, or measured values imported from an ICDM file, or both.

Interference tables are further used as input to Automatic Frequency Planning (AFP) and for manual quality check when you Display Interference Tables. You can also Export Interference Tables for post-processing.

When you perform Automatic Frequency Planning (AFP) you will select to what extent predicted or imported values, or a combination of predicted and imported values (recommended), are fetched from the interference tables.

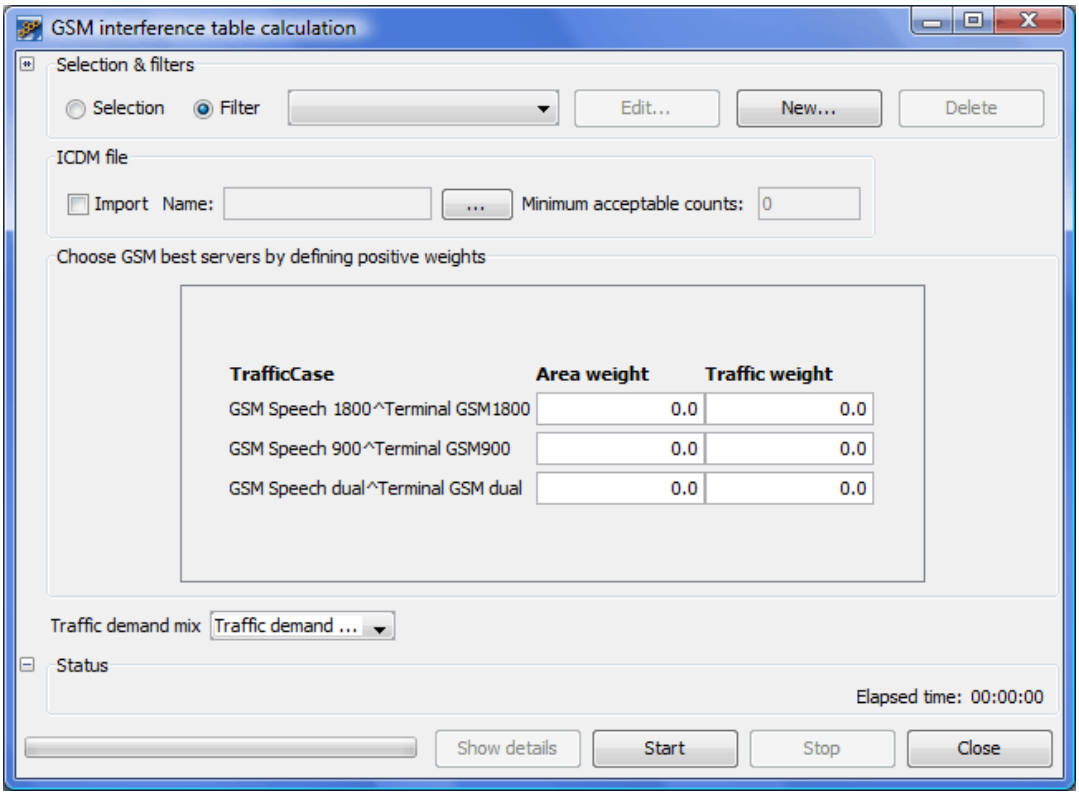
Prerequisites

- Read About Interference Tables on page 15-24.
- Best server analysis is performed, see Calculate GSM Best Server on page 15-8.

Procedure

Do as follows to create interference tables:

1. Select **Analysis↗GSM↗Calculate interference table**. The **GSM interference table calculation** window is displayed.



2. To create an interference table with imported values only, select the **Import** option and enter the **Name** of the ICDM file. Set the desired value of **Minimum acceptable counts**.
3. To create interference tables with predicted values only, clear the **Import** option and set **Area weight**s and **Traffic weight**s for the traffic cases to predict. Select a **Traffic demand mix**.
4. To create interference tables with imported as well as predicted values, follow the instructions in Step 2 and Step 3. The **Import** option shall be selected.
5. Click **Start**. The interference tables are created.

Fields on Window "GSM interference table calculation"

ICDM file	
Import	Option enabling selection of **Name** and **Minimum acceptable counts**.
Name	Name of the ICDM file in tab delimited text format.
Minimum acceptable counts	In an imported ICDM file, every cell-to-cell relationship is based on a number (count) of interference measurements. If the number of measurements of a cell-pair is higher than the minimum, the imported value is used in actual count is less than the specified minimum, the value of that cell-pais is not imported.
Choose GSM best servers by defining positive weights	
Traffic case	Traffic case used to calculate best server. Use only traffic cases that have already been used to calculate best server.
Area weight	Area weight factors used in average interfered area calculation. Normalized over traffic cases, which means that these weights affect the weighting of interfered area between different traffic cases, but not the overall weighting of interfered area vs. interfered traffic.
Traffic weight	Traffic weight factors used in average interfered traffic calculation. Normalized over traffic cases, which means that these weights affect the weighting of interfered traffic between different traffic cases, but not the overall weighting of interfered area vs. interfered traffic.
Traffic demand mix	Pre-defined traffic demand mix. If you select a mix that does not contain all the selected traffic cases, the calculation results may be misleading.

Display Interference Tables

After an interference table has been calculated and/or imported, you can display the interference table of any pair of interfered and interfering cell in the map window.

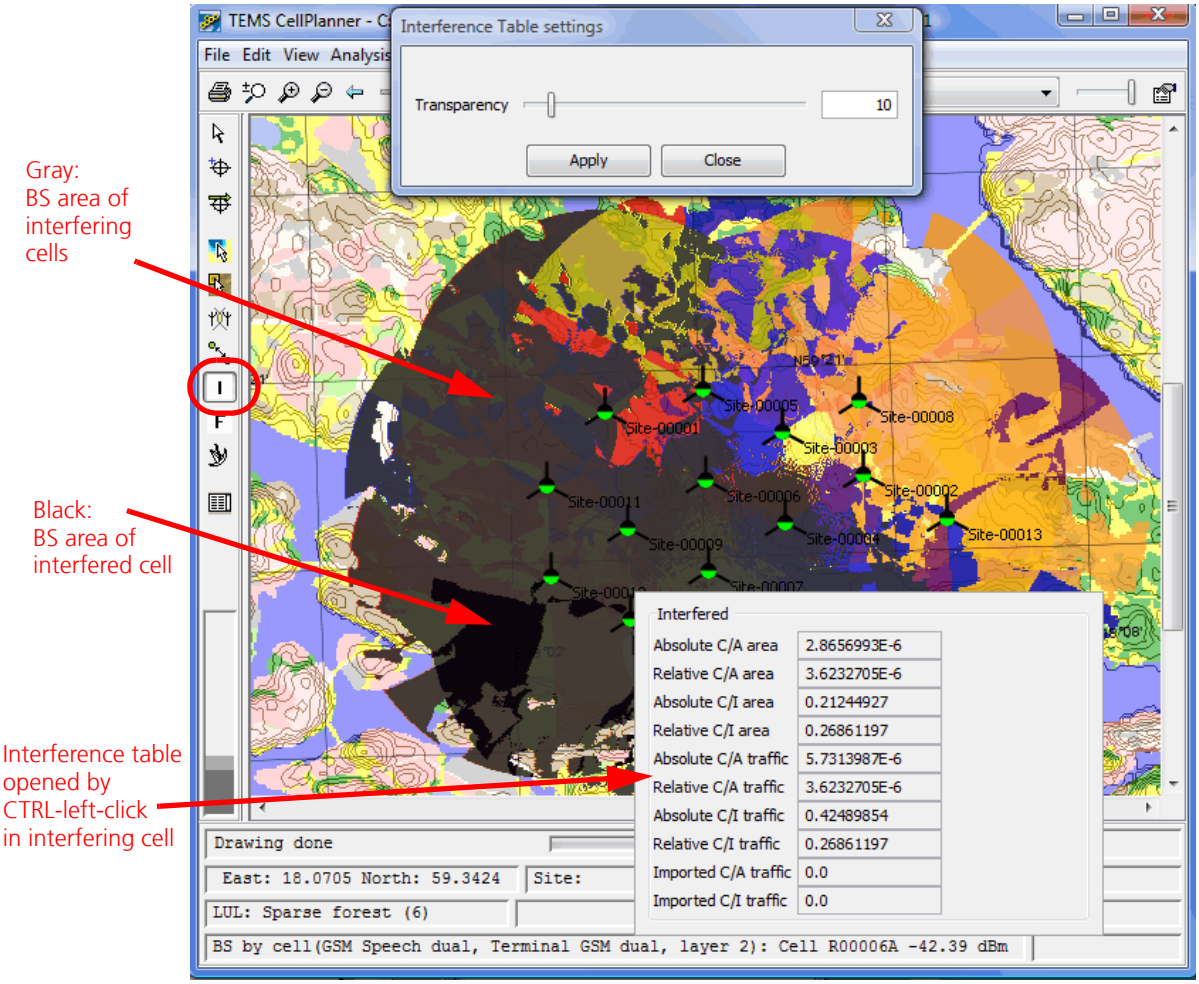
Prerequisites

Inter-cell interference values are provided, see Calculate and/or Import Interference Tables on page 15-26.

Procedure

Do as follows to display an interference table:

1. Display a Best server by cell plot for the traffic case used to create the interference table. See Best Server Plots on page 16-4.
2. Click the I button or select **Analysis↗GSM↗Interference table cursor** from the menu.
3. Click in any cell's coverage area to select it as the interfered cell. Its coverage area is colored in black, and the coverage area of interfering cells become gray.
4. **CTRL-left-click** any interfering cell to display its impact on the interfered cell. Imported interference values are displayed, if present.



The interference table provides the following information:

Absolute C/A Area	Absolute carrier to adjacent channel interfered area
Relative C/A Area	Relative carrier to adjacent channel interfered area

Absolute C/I Area	Absolute carrier to co-channel interfered area
Relative C/I Area	Relative carrier to co-channel interfered area
Absolute C/A Traffic	Absolute carrier to adjacent channel interfered traffic
Relative C/A Traffic	Relative carrier to adjacent channel interfered traffic
Absolute C/I Traffic	Absolute carrier to co-channel interfered traffic
Relative C/I Traffic	Relative carrier to co-channel interfered traffic
Imported C/A Traffic	Imported carrier to adjacent channel interfered traffic, if applicable
Imported C/I Traffic	Imported carrier to co-channel interfered traffic, if applicable

Interference Analysis

TEMS CellPlanner calculates interference parameters for every bin in a given best server plot. The interference caused by a cell on a traffic carrier is proportional to the cell's traffic load factor found in the cell data. You can apply the traffic load factor to each cell manually, or you can use the calculation results from Traffic Performance Analysis.

Calculating interference data shows interfered serving cells selected by a traffic case from a set of several Interfering traffic cases. Interference hitting the serving cells is generated by the total traffic assigned to the Interfering traffic cases. The analysis uses the pathloss from every sub-cell to all bins meeting requirements for maximum distance.

Signal to Interference Ratio

Interference data shows every bin in the map window with a specific color to indicate the signal to interference ratio: the ratio between the received signal strength of the serving sub-cell and the co-channel and/or adjacent channel interference.

Analysis Includes Sub-cells

Overlaid and underlaid sub-cells are always analyzed, both as serving and interfering cells.

Definition of Interferer

A cell - overlaid or underlaid sub-cell, or an ordinary cell - is an interferer if it meets the following criteria:

- belongs to a site selected for any of the interfering traffic cases
- has prediction data that overlaps the given bin
- at least one of its carriers and an analyzed carrier use
  - the same frequency, causing *co-channel interference*
  - adjacent frequencies, causing a*djacent channel interference*
  - the same or adjacent frequencies, causing c*o- and adjacent channel interference*

The serving cell at any given bin is the one defined by the best server identity display for the current choice of serving traffic case.

Synchronized Cells

The HSN and MAIO values are used in the interference analysis only when the serving cell and interfering cell are co-sited, and their RBS has the Synchronized option selected Ensure that the network system supports synchronized sites.

Frequency Hopping

You can analyze baseband and synthesizer frequency hopping as well as fixed frequency assignments. The frequency for every channel group must be defined as fixed or hopping.

Baseband hopping	Baseband hopping occurs when the number of transceivers in a frequency hopping channel group equals the number of hopping frequencies (is the same size as the hopping frequency set).
Synthesizer hopping	Synthesizer hopping occurs when the number of hopping frequencies exceeds the number of transceivers in the channel group.

Calculate GSM Interference Data

Use this procedure to calculate interference data and check the quality of the frequency plan for a GSM network.

Carrier to Interference Ratio

The carrier-to-interference ratio (C/I) should exceed a certain limit, usually 9 to 12 dB for GSM, to ensure sufficient signal quality. The limit depends on the analyzed carrier type - BCCH or TCH - and if the frequency plan is based on fixed frequencies or frequency hopping.

Achieved Bit Rate for GPRS and EGPRS

The maximum achieved bit rate for GPRS and EGPRS depends on the C/I. When there is GPRS/EGPRS traffic in the project, you must re-calculate traffic performance using the results of calculating interference data to update the bitrates and the dimensioning that depends on them.

Prerequisites

The following must be done before you can calculate interference data:

- A GSM network with GSM Sites, RBSs and Cells are defined.
- Pathloss is calculated.
- Best Server Analysis is performed
- Frequency Group Sets are planned with option **Include BCCH ARFCNs** enabled. With this option enabled, the frequency group set gets a BCCH frequency (carrier zero) in one channel group per cell (or one sub-cell of each cell).
- Frequency Planning in TEMS CellPlanner is performed, with individual frequencies for all transceivers or a hopping frequency set assigned to every channel group in every cell

Parameters Affecting Calculations

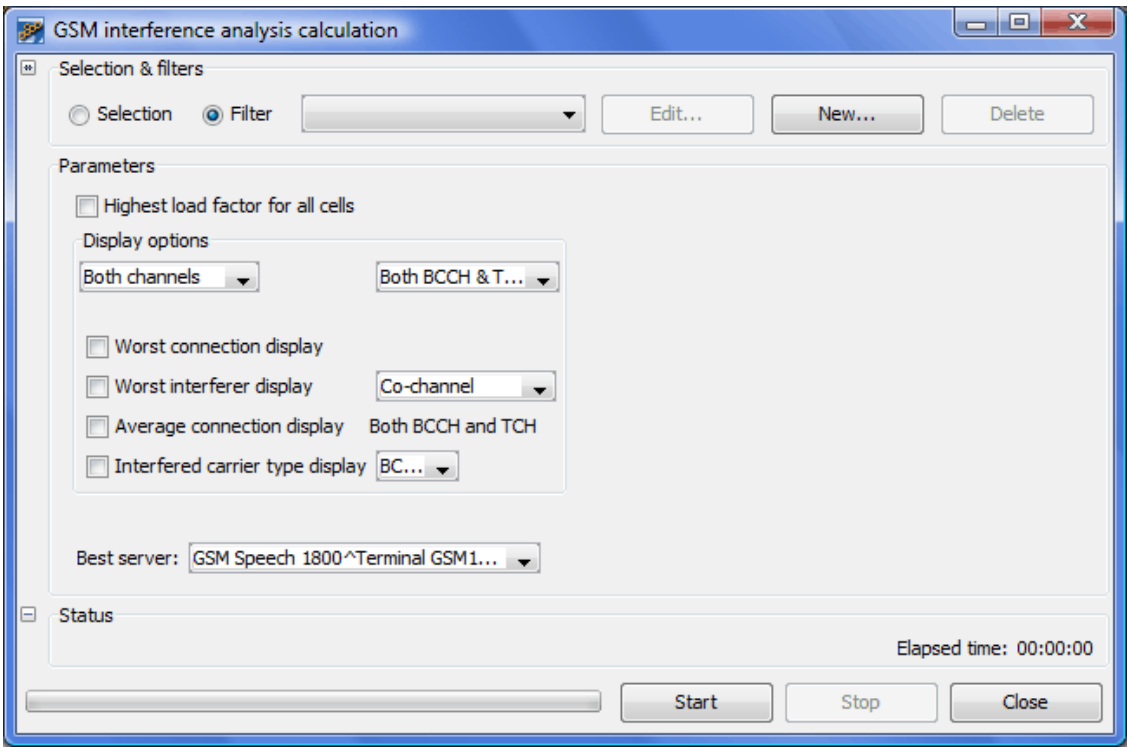
The values affecting calculations include frequency diversity gain, DTX and power control options.

- Change frequency diversity gain values for numbers of hop frequencies, adjacent channel attenuation, the DTX factor, and power control using **File↗Project settings↗GSM parameters**.
- Enable or disable DTX and power control for cells in parameters **Use power control factor** and **DTX factor** in the GSM cell **Configuration↗Power** tab.

Procedure

Follow these steps to calculate interference data for GSM project:

1. Select **Analysis↗GSM↗Calculate interference data** to display the **GSM interference analysis calculation** window.



2. To calculate a worst case of traffic load, select **Highest load factor for all cells**.
3. Select the appropriate **Display options** to enable production of the desired interference plots.
4. Select the traffic case for which to display the **Best server**.
5. Click **Start** to generate the plots.

Fields on Window "GSM interference analysis calculation"

Highest load factor for all cells	If selected, the load factor of all interfering cells is set to 1.0, which is the maximum. Enabling this option overrides cell specific load factor settings. See Load Factor in Cells on page 15-13 and Configure General GSM Cell (or Underlaid Sub-Cell) Parameters on page 9-12.
Display options - rules which plots will be produced by the analysis	
(type of interference to display)	Calculation will produce plots for **Co-channel** and/or **Adjacent channel** interference.
(type of channel to display)	Calculation will produce plots for **BCCH** and/ or **TCH**
Worst connection display	Calculation will produce a worst connection plot. If there is practically no interference, a default value of 41 dB is displayed for all bins.
Worst interferer display	Calculation will produce a worst interferer plot for **Adjacent channel** or **Co-channel** interference.
Average connection display	Calculation will produce a worst connection plot. If there is practically no interference, a default value of 41 dB is displayed for all bins.
Interfered carrier type display	Calculation will produce a plot showing the interference on **BCCH** or **TCH**.
Best server	Selects the bearer to use for calculating interference

Recall GSM Configuration

You can recall an applied frequency plan from the AFP or the Manual frequency planning, or from a new BSIC, HSN or MAIO plan. Use this procedure to remove changes of a frequency plan.

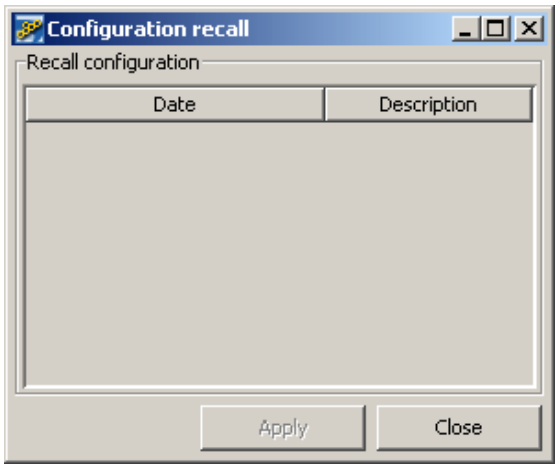
Prerequisites

A frequency plan from a certain date is available.

Procedure

Follow these steps to recall a GSM configuration:

1. Select Analysis↗GSM↗Recall configuration to display the Configuration recall window.



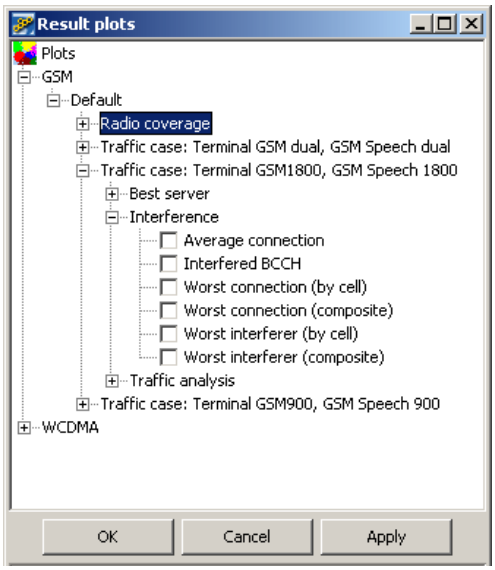
2. Select the change you want to remove, for example the last AFP.
3. Click Apply. The configuration is rolled back to the one before the recalled change.

Fields on Window "Configuration recall"

Date	The date of the configuration you want to get back to
Description	A description of the configuration

Display GSM Interference Analysis Results

Use the **Result plots** window to display result plots from interference analysis:



Depending on the results you select, the following plots are available:

- The Worst Connection frequency channel number and C/I [dB] and sub-cell identity
- The Average Connection C/I [dB]
- The Worst Interferer frequency channel number, C/I [dB] and cell identity
- The C/I [dB] of Carrier Zero
- The average C/I (dB) of all TCH carriers

When no interference is found, a color representing the upper C/I bound (41 dB) is displayed. The status bar below the map window displays the word 41 dB.

Frequency Hopping

When the worst connection or worst interferer appears on a frequency hopping channel group, the channel group ID is displayed instead of the frequency channel number.

When the worst connection appears on a frequency hopping connection, the identity of the FH Channel Group is displayed instead of the frequency channel number.

Best Server Signal Strength

If the best server signal strength in a bin is too low, or the propagation time is too long, nothing is displayed for that bin.

Neighbor Analysis

Chapter Neighbors in the *TEMS CellPlanner Common Features User's Guide* contains a more up-to-date description on how you can add, modify and delete neighbors. The descriptions below will be aligned in a later release.

TEMS CellPlanner can calculate a list of neighbors to all cells included in a selected traffic case, where the possible neighbors are selected by means of the same or another traffic case. Traffic distribution is not needed for this analysis.

Using filters, you can select the set of cells to be included in the analysis.

When you optimize, import or load a neighbor list, you can evaluate and edit the optimized neighbor list.

You can import the neighbors of every cell from a file. You can export a neighbor list from the project database to a file.

After you apply a neighbor list to the project database, you can display all types of neighbor relations graphically in the map display window.

Output of Neighbor List Optimization

After you analyze neighbor lists and apply the output to the project database, the neighbor cell information is used by such functions as frequency plan optimization and scrambling code optimization.

Region of Overlap for Cells

A region of overlap is defined for every pair of cells. In this region, the received signal strength for both cells is above the handover threshold for the respective cells.

Neighbor List Optimization Uses Traffic Cases

When you start neighbor list optimization, you specify a set of cells (the cells from which the neighbor relations are calculated) by selecting a traffic case.

For inter-technology (IRAT) neighbor lists, you specify the set of potential neighbor cells by selecting another traffic case.

Neighbor List Qualifications

A neighbor list defines the set of cells to which a mobile station can perform a handover. Cells must meet certain qualifications to be considered.

Technologies Supported

Neighbor lists can be generated for pure GSM, GSM with GPRS, or GSM with EGPRS.

Types of Cells for GSM Neighbor List Optimization

In neighbor list optimization, cells are considered to be either *origin* cells or *neighbor* cells, as described in the following table:

Origin cell	Origin cells meet the following criteria: • It belongs to a site in the selected site filter. • It belongs to the selected origin network. • For GSM networks, its BCCH frequency belongs to a band supported by the selected origin traffic case. • If the selected origin traffic case uses GPRS, the cell supports GPRS. • If the selected origin traffic case uses EGPRS, the cell supports GPRS and contains at least one timeslot configured for EDGE.
Neighbor cell	A cell must fulfill the following criteria in order to be included in the calculations as a neighbor cell: • It belongs to the selected target network. • For GSM networks, its BCCH frequency belongs to a band supported by the selected target traffic case • If the selected target traffic case uses GPRS, the cell supports GPRS. • If the selected target traffic case uses EGPRS, the cell supports GPRS and contains at least one timeslot configured for EDGE.

Types of Neighbor Lists

The following types of neighbor lists are possible for a GSM cell:

- GSM neighbors: cells that use the same or another GSM frequency band.
- Inter-technology neighbors: cells that belong to WCDMA networks.

You can add Neighbor relations into the database using the up/down arrows on the **Neighbor list details** window, or using the cell-related windows of the RBS explorers.

You can delete Neighbor relations from the database. This can be performed in the Detailed Neighbor information window or in the site database.

Neighbor List

The neighbor list provides separate tabs for intra-cell and inter-cell neighbors. It shows the **Total overlap** of cell neighbor boundaries and **Useful overlap**. For GSM, **Useful overlap** means that the signal strength is within the handover margin. Both values are expressed as percentages of the cells' best server area.

The table below describes the status conditions for cells on the **Neighbor** list:

Confirmed	A relation generated for the neighbor list and already present in the site database.
New	Generated relation that is not present in the site database.
Confirmed but not created	A relation that is present in the site database but was not generated on the neighbor list.
Added by user	Relation added by the user after optimizing the neighbor list.

Waiting List

The table below describes the status conditions for cells on the **Waiting list**:

No useful overlap	Candidates with no overlap within the handover margin are placed on the waiting list when the target cell's neighbor list has the minimum required neighbor relations.
Exceeded list length	Candidates on the waiting list are there because the list of qualified neighbors reached the maximum allowed.

Error List

The table below describes the status conditions for cells on the **Error list**:

Deleted by user	Neighbor relation removed from the Neighbor List
Wanted by reverse Neighbor	The target cell's neighbor list has the maximum neighbor relations. Force mutual cannot be achieved due to maximum neighbors.

Generate GSM Neighbor Lists

Use this procedure to optimize lists of GSM cells that are neighbors of other cells in a GSM network plan.

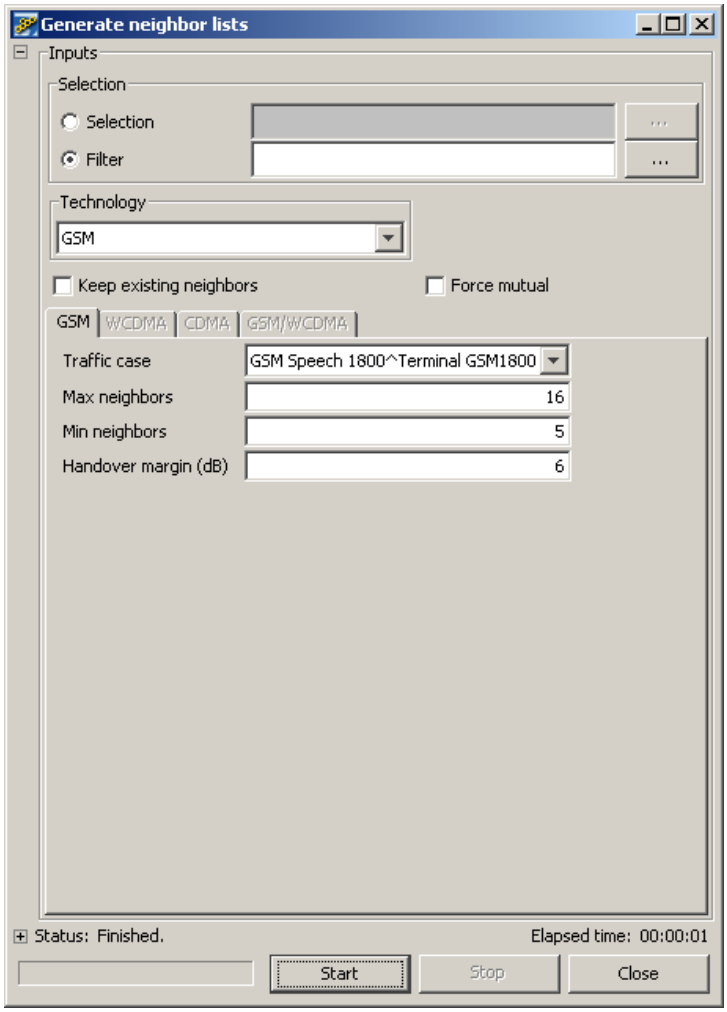
Prerequisites

Before optimizing a neighbor list, you must create one or more best server plots for the technology and traffic cases (bearer plus terminal) you select.

Procedure

Follow these steps to generate neighbor lists for a GSM network plan:

1. Select **Analysis↗Neighbor list↗Optimize neighbor lists↗Generate neighbor lists** to display the **Generate neighbor lists** window.



2. In the technology list, select **GSM**.
3. Select a traffic case.
4. Make entries in other fields as required.
5. Click **Start** to generate the neighbor list results. The **Evaluate neighbor list** is displayed.
6. Proceed with Evaluate GSM Neighbor Lists on page 15-40.

Fields on Window "Generate neighbor lists"

Technology	The network technology to use for list generation.
Keep existing neighbors	Any neighbor relations existing in the project database are maintained during neighbor list generation.
Force mutual	Forces the neighbor relations on the list to be mutual.
Traffic case	The traffic case to use in the analysis, traffic case containing the potential neighbor cells.
Max neighbors	The maximum allowed neighbors for the cells. Max = 64.
Min neighbors	The minimum required neighbors for the cells.
Handover margin (dB)	GSM handover margin in dB

Evaluate GSM Neighbor Lists

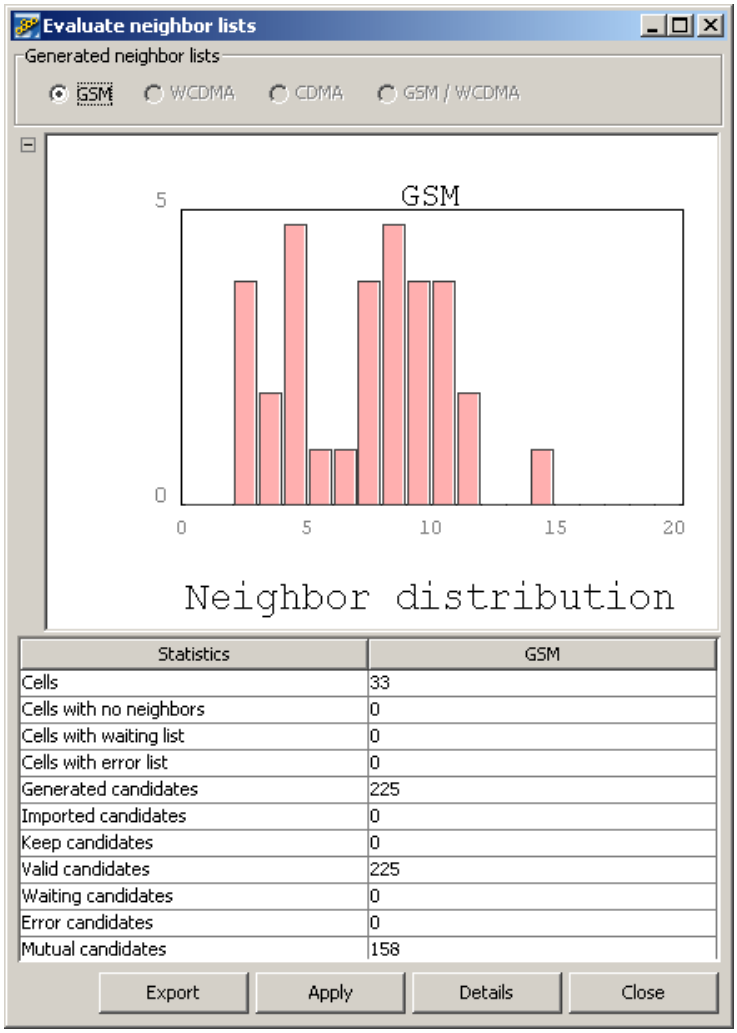
Use this procedure to evaluate the generated neighbor list for a GSM network plan. The list shows the candidate neighbors for the origin cell and selected neighbor list.

You can retain the neighbor relations already in the database, and those relations are copied to the list of neighbor candidates.

Procedure

Follow these steps to view neighbor analysis results:

1. Select **Analysis↗Neighbor list↗Evaluate neighbor lists.** A graph with neighbor distribution and a table with neighbor statistics are displayed.



2. To view the details of the neighbor list, proceed with Evaluate Details of GSM Neighbor Lists on page 15-42.

3. To accept the neighbors in the neighbor lists, click **Apply.** You may now view the neighbors in the **GSM RBS explorer** and on the map display. See Add Individual Neighbor Relations on page 15-47 and Display Neighbor Cells Graphically on page 15-49.

Fields on Window "Evaluate neighbor lists"

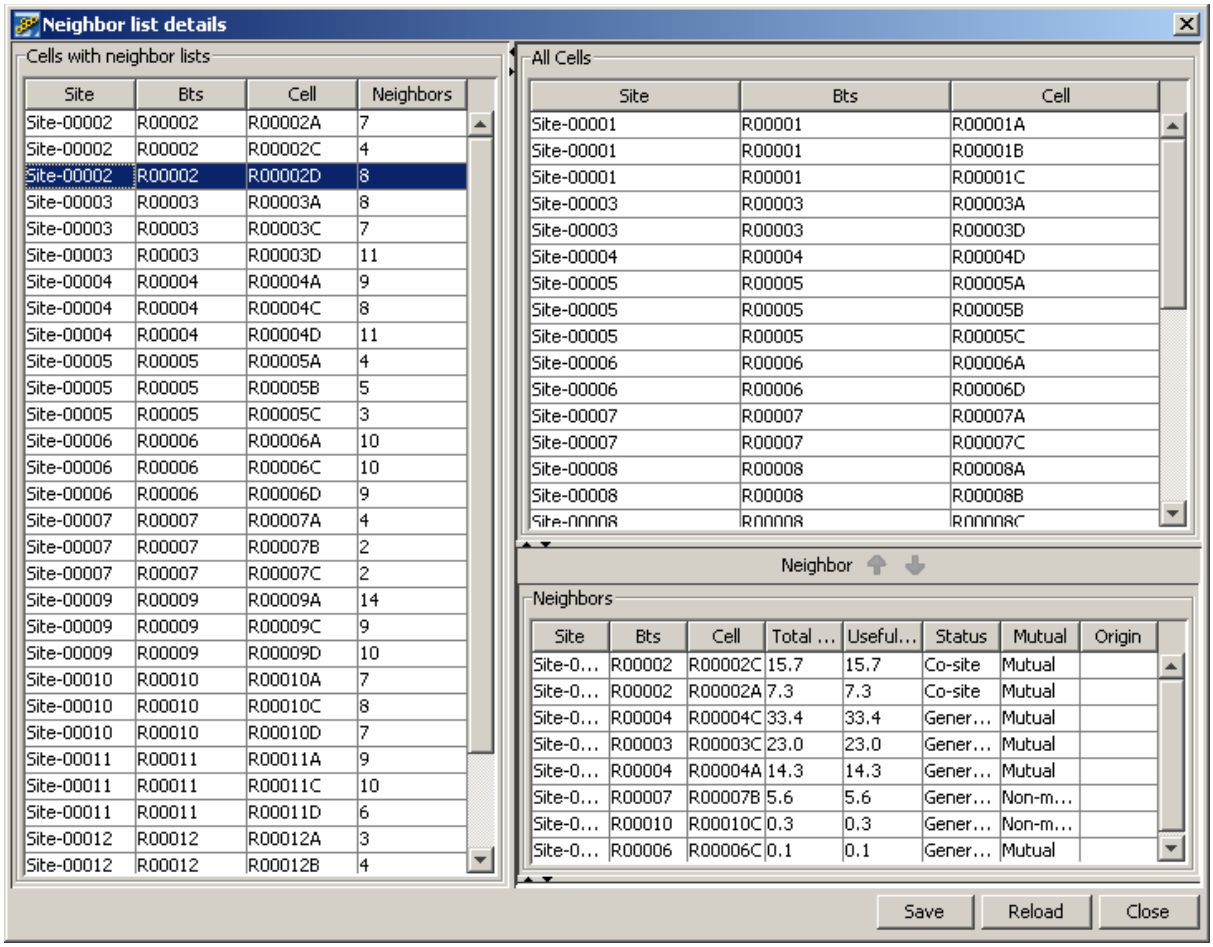
Generated neighbor lists	Selection of technology for which to display neighbor lists. Relevant if other technologies than GSM included in the project.
Neighbor distribution chart	Histogram over neighbor distribution. The x axis displays the number of neighbors, the y axis the number of cells. In the example, there is 1 cell with 6, 7 and 14 neighbors each, 2 cells with 4 and 12 neighbors each, 4 cells with 3, 8, 10 and 11 neighbors each, and 5 cells with 5 and 9 neighbors each.
(neighbor statistics)	For each GSM frequency band, the neighbor statistics include: • Number of cells • Number of cells with no neighbors • Number of cells with waiting list • Number of cells with error list • Total number of generated candidates • Total number of imported candidates • Total number of keep candidates • Total number of valid candidates • Total number of waiting candidates • Total number of error candidates • Total number of mutual candidates
Export	Exports neighbor list data to a text file.
Apply	Applies the neighbor relations to the cell data.
Details	Displays details of the neighbor relations generated.

Evaluate Details of GSM Neighbor Lists

The Neighbor list details window displays a list of all origin cells considered in the neighbor list generation.

For each neighbor, the lists shows the cell ID along with the neighbor relation status, and the percentages of the useful overlap and total overlap of the origin and target neighbor cells.

Use the **Neighbor list details** window to work with details of neighbor lists:



Fields on Window "Neighbor list details"

Cells with neighbor lists	All cells on the generated list with neighbors
All cells	All cells in the network plan
Neighbor ↑ ↓	To move a cell from the **neighbors** list to the **waiting** list, click the down arrow. To move a cell from the **waiting** list to the **neighbors** list, click the up arrow.
Neighbors	List of neighbors for the cell selected in the **Cells with neighbors** list
Neighbor ↑ ↓	To move a cell from the **neighbors** list to the **waiting** list, click the down arrow. To move a cell from the **waiting** list to the **neighbors** list, click the up arrow.
Waiting list	A list of potential candidates for neighbors of the origin cell.
Error list	A list of cells that do not qualify as neighbors of the origin cell.
Save	Saves the current neighbor list to the calculation results directory. You can reload the saved list at a later time.
Reload	Reloads a saved neighbor list from the calculation results directory.

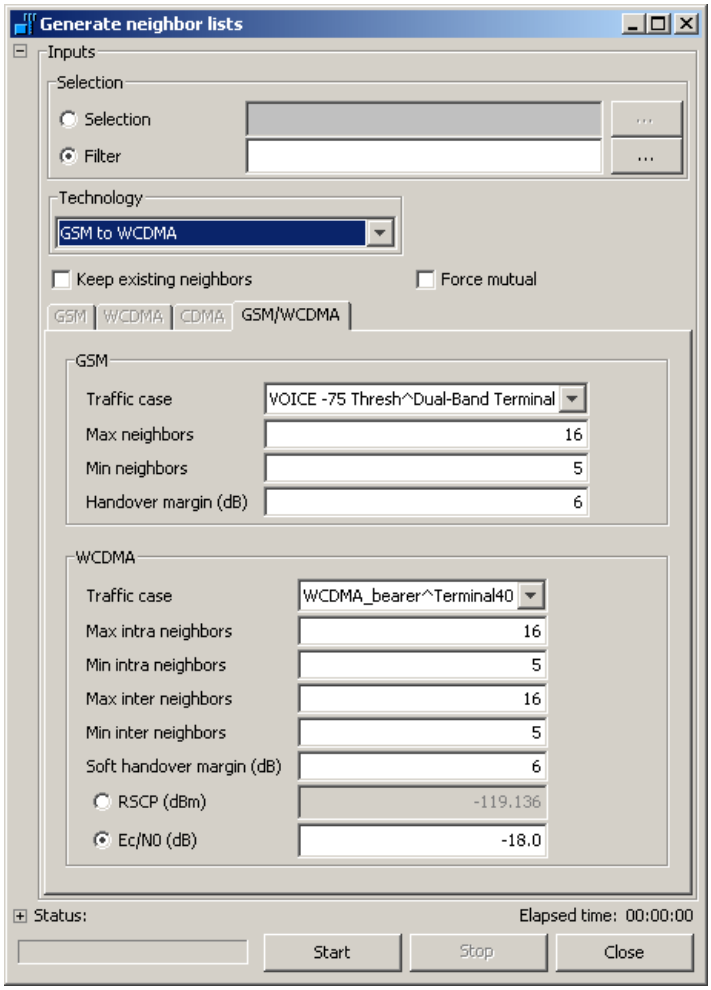
Generate WCDMA/GSM Neighbor Lists

Use this procedure to optimize lists of GSM and WCDMA cells that are neighbors.

Procedure

Follow these steps to generate neighbor lists for a GSM/WCDMA network plan:

1. Select **Analysis↗Neighbor list↗Optimize neighbor lists↗Generate neighbor lists** to display the **Generate neighbor lists** window.



2. In the technology list, select **GSM to WCDMA**.
3. Select a traffic case.
4. Select the same traffic case in the "Technology" column of the table.
5. Click **Start** to generate the neighbor analysis results.

Fields on Window "Generate neighbor lists"

Technology	The network technology to use for list generation.
Keep existing neighbors	Any neighbor relations existing in the project database are maintained during neighbor list generation.
Force mutual	Forces the neighbor relations on the list to be mutual.
Traffic case	The GSM traffic case to use in the analysis (the traffic case containing the potential neighbor cells).
Max neighbors	For GSM, the maximum neighbors allowed for origin cells
Min neighbors	For GSM, the minimum neighbors required for origin cells
Handover margin (dB)	GSM handover margin in dB.
Traffic case	The WCDMA traffic case containing the potential neighbor cells
Max intra neighbors	For WCDMA, the maximum length of the neighbor list generated between cells with the same frequencies. Max = 64 (GSM); 31 (WCDMA)
Min intra neighbors	For WCDMA, the minimum length of the neighbor list generated between cells with the same frequencies.
Max inter neighbors	For WCDMA, the maximum length of the neighbor list generated between cells using different frequencies. Max = 32
Min inter neighbors	For WCDMA, the minimum length of the neighbor list generated between cells using different frequencies.
Soft handover margin (dB)	WCDMA soft handover margin in dB
RSCP (dBm)	Received Signal Code Power in dBm.
Ec/NO (dB)	The minimum signal quality of the pilot (or CPICH) required for a target cell using WCDMA. Default -18 dB

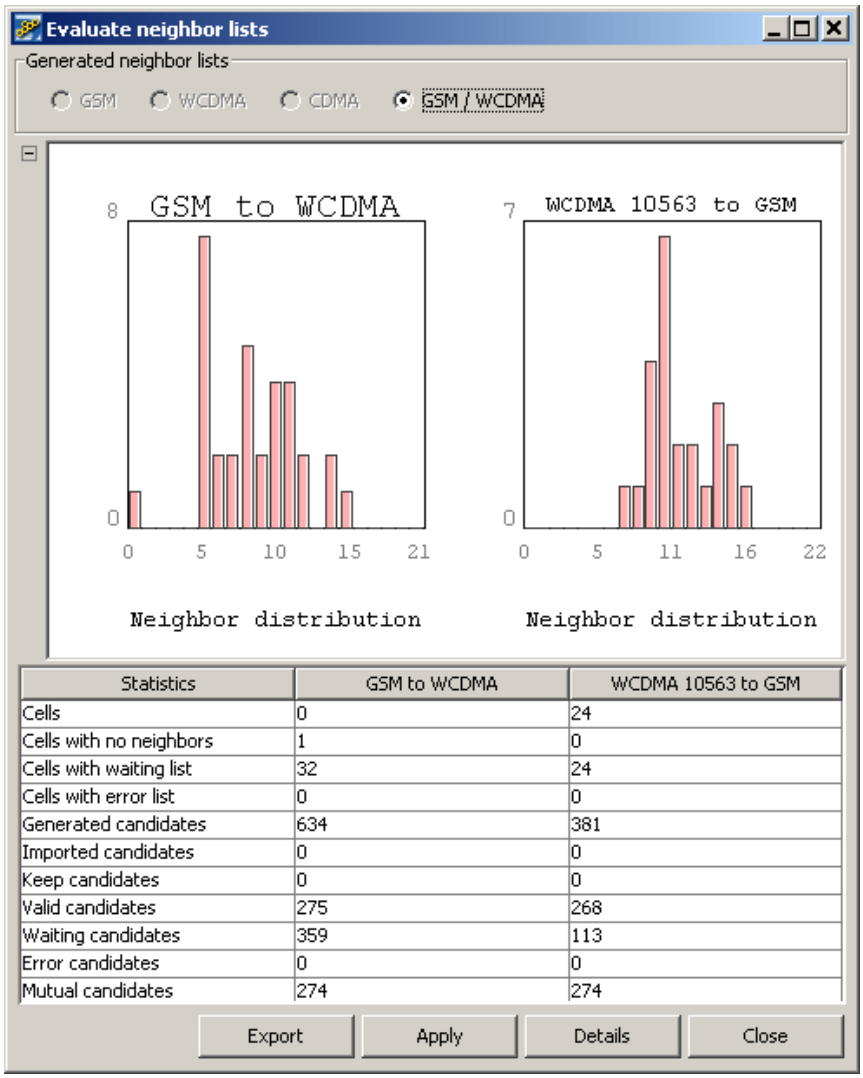
Evaluate WCDMA/GSM Neighbor Lists

Use this procedure to evaluate the generated neighbor list for a GSM/WCDMA network plan.

Procedure

Follow these steps to view neighbor analysis results:

1. In the **Neighbor analysis results** window, select a cell.



Statistics	GSM to WCDMA	WCDMA 10563 to GSM
Cells	0	24
Cells with no neighbors	1	0
Cells with waiting list	32	24
Cells with error list	0	0
Generated candidates	634	381
Imported candidates	0	0
Keep candidates	0	0
Valid candidates	275	268
Waiting candidates	359	113
Error candidates	0	0
Mutual candidates	274	274

2. Its neighbors (cells with an overlap exceeding 10%) and non-neighbors (cells with an overlap between 0 and 10%) are displayed. Cells with no overlap are not displayed.

Fields on Window "Neighbor analysis results"

GSM	Displays neighbor lists generated for GSM
WCDMA	Displays neighbor lists generated for WCDMA
GSM/WCDMA	Displays neighbor lists generated for GSM and WCDMA
(neighbor statistics)	For each WCDMA frequency band, the neighbor statistics include: • Number of cells • Number of cells with no neighbors • Number of cells with waiting list • Number of cells with error list • Total number of generated candidates • Total number of imported candidates • Total number of keep candidates • Total number of valid candidates • Total number of waiting candidates • Total number of error candidates • Total number of mutual candidates
Export	Exports neighbor list data to a text file.
Apply	Applies the neighbor relations to the network plan.
Details	Displays details of the neighbor relations generated.

Add Individual Neighbor Relations

Use this procedure to add individual neighbor cell relations to the project. Neighbor cell relations are used to optimize a frequency plan, and are also used by the operations and maintenance system.

Adding and changing neighbor relations in this window updates the cell information in the project database.

Prerequisites to Display Neighbor Relations

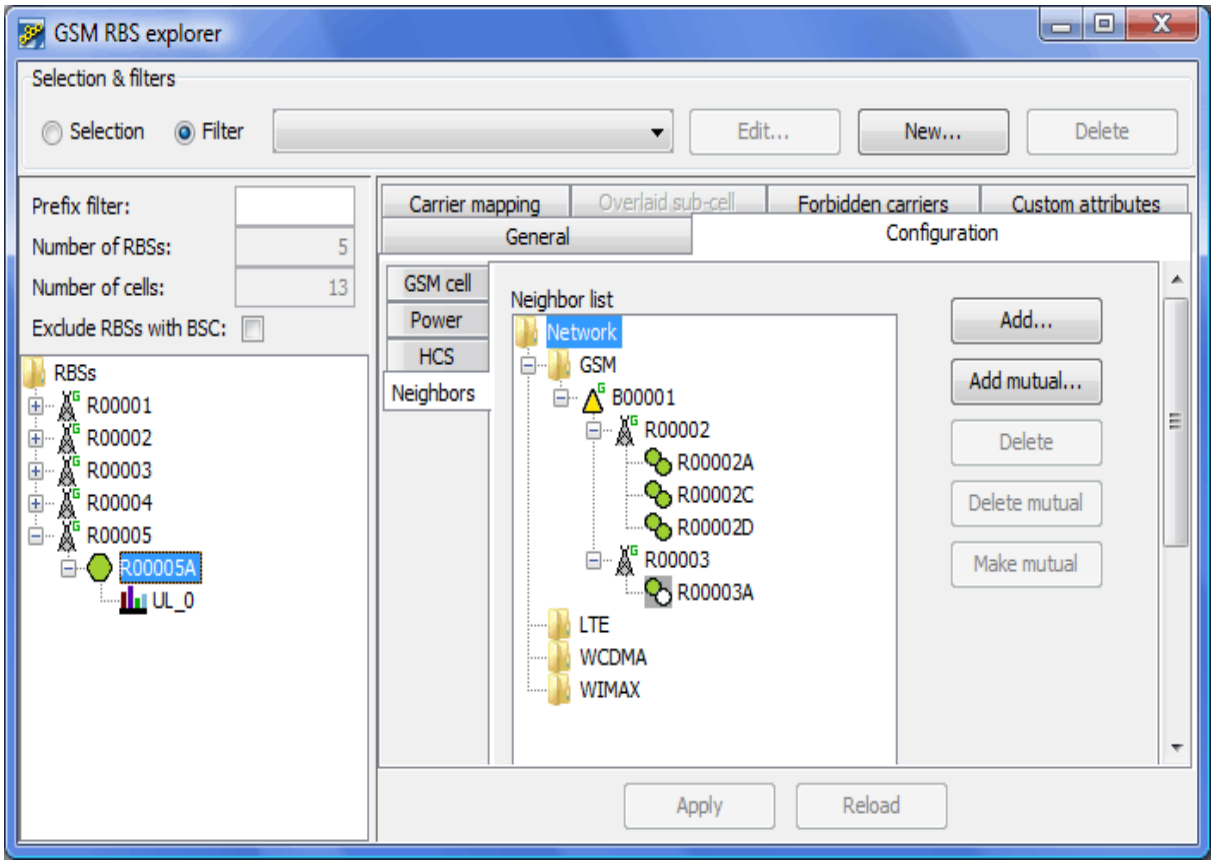
Load two network map layers, for example a WCDMA network layer and a GSM network layer.

Procedure

Follow these steps to add neighbors to cells:

1. Using an RBS explorer, select the cell(s) for which to add neighbors.

2. Select **Configuration↗Neighbors** to display the **Neighbor List** window.



3. Highlight the folder of the technology appropriate for the neighbor cell to add as a relation, and right-click the mouse to display the **Cell selection (Add)** window.
4. In the RBS hierarchy displayed for the technology, select the RBS and cell to add as a neighbor relation.
5. Click **Add** to add the neighbor relation with the selected cell.

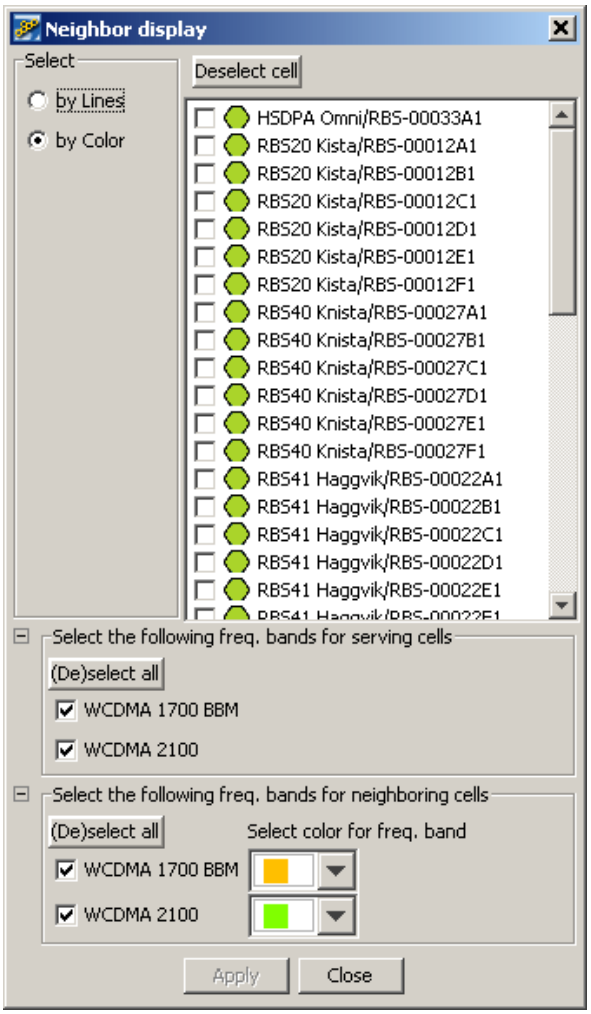
Fields on Window "Cell - Configuration - Neighbors"

Neighbor list	Shows the neighbors for a cell, organized by technology and then by RBS. Mutual cell relationships are displayed with a double green cell icon. Non-mutual relationships are displayed with a green/white cell icon. The list indicates when the relation is mutual, meaning that the origin cell is also included on the neighbor list of the target cell.
Add...	Displays the Cell selection (Add) window for adding neighbor cells to the highlighted cell. Makes the cell relationship non-mutual.
Add mutual...	Displays the Cell selection (Add mutual) window for adding a mutual cell neighbor relationship.
Delete	Deletes a neighbor relationship from a cell.
Delete mutual	Deletes a mutual relationship from the original cell and its neighbor.
Make mutual	Makes a cell relationship mutual between two cells.

Display Neighbor Cells Graphically

When you graphically display neighbor relations that have been applied to the database, you clicking on a cell symbol, and the neighbor cells are indicated by colors or arrows connecting the cell symbols.

Use the **Neighbor display** window to activate the neighbor cell display:



Fields on Window "Neighbor display"

Display by lines	Map display window shows neighbor relations by lines connecting cells/sectors.
Display by color	Map display window shows neighbor relations by colors showing neighbor relations.
Frequency bands for serving cells	Frequency bands of the serving cells to display.
Frequency bands for neighboring cells	Frequency bands of the neighboring cells to display.

Neighbor Display by Lines

Neighbor display by lines, describing mutual neighboring information by red/black and Neighbor cell frequency band by blue/yellow. One serving cell indicates the Neighbor cell(s) by one line for each frequency band of a Neighbor cell.

The line between the serving cell and the neighboring cell contains information of mutual/non mutual neighbor cell and the frequency band selected. The line is divided in the middle, to be able to represent the mutuality at the first part from the serving cell to the middle and to represent frequency band at the rest of the line.

The color of the first half of the line from the serving cell carries the information (red or black) for non-mutual respective mutual neighboring cells.

When finding more than one neighbor cell at a cell position, each cell position is considered to be on a line, separated by a small distance within the cell symbol, perpendicular to the neighbor line connecting serving and neighbor cell.

A line is drawn from the serving cell to the neighbor cell position for each frequency band.

Neighbor Display by Colors

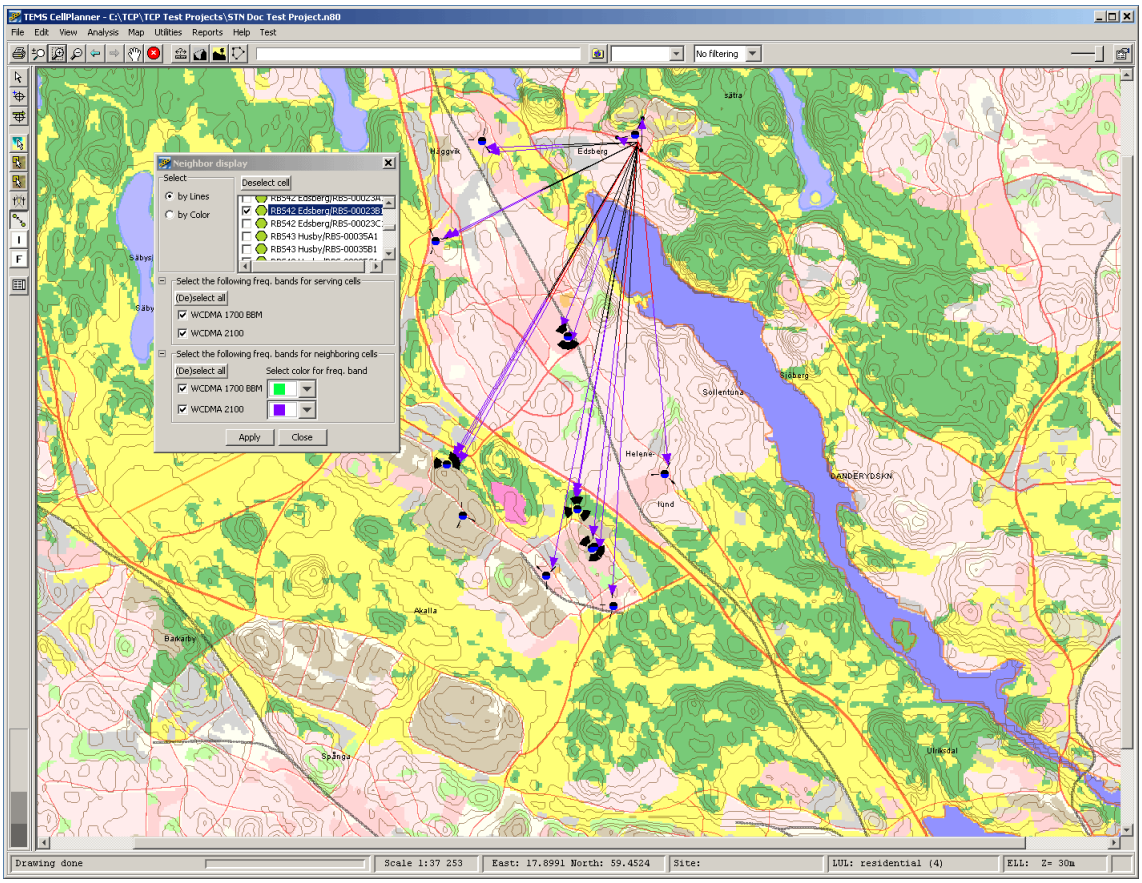
The serving cell is always red. The neighbor cell colors represent the frequency bands of the neighboring cells.

To be able to represent frequency band by colors for the neighboring cell, the cell has to be divided into smaller sections, as many as frequency bands for that azimuth.

Mutual relations cannot be displayed color, in the serving cell.

Example of Neighbor Display

The following illustration of Neighbor display by colors for multi RBSs per site shows neighbor cells are here represented by sub-sections with one color for each frequency band.


TEMS CellPlanner - E:\TCP\TCP Test Projects\STN Doc Test Project.n80
File Edit View Analysis Map Utilities Reports Help Test
No filtering
Neighbor display
Select
Deselect cell
by Lines
by Color
RB542 Edsberg/RBS-00023B
RB542 Edsberg/RBS-00023C
RB543 Husby/RBS-00035A1
RB543 Husby/RBS-00035B1
Select the following freq. bands for serving cells
(De)select all
WCDMA 1700 BBM
WCDMA 2100
Select the following freq. bands for neighboring cells
(De)select all
Select color for freq. band
WCDMA 1700 BBM
WCDMA 2100
Apply
Close
Edsberg
Sollentuna
Akalla
Bankarby
Spånga
Drawing done
Scale 1:37 253
East: 17.8991 North: 59.4524
Site:
LUL: residential (4)
ELL: Z= 30m

Troubleshooting Analysis Results

Only Co-Sited Cells as Neighbors

Sometimes a cell does not get any other neighbor than its co-sited cells from the Neighbor Analysis. The explanation is that the cell has no best server area, since it is completely overlapped by other stronger cells.

You can solve this problem in different ways:

- If the cell appears as a non-mutual neighbor to surrounding cells, select the **Force mutual** box in the **Generate neighbor lists** window, or use the **Make mutual** button for the surrounding cells in the **GSM RBS explorer**.
- Enhance the coverage of the cell by increasing its power.
- Enhance the coverage of the cell by giving it a higher HCS priority.
- Use a higher resolution in the pathloss prediction to obtain a more visible coverage of the cell.

Problems with Importing ICDM Files

See Using Imported Interference Tables (ICDM) in AFP on page 18-8.

16
GSM Plots

This chapter describes the plots of a GSM network plan.

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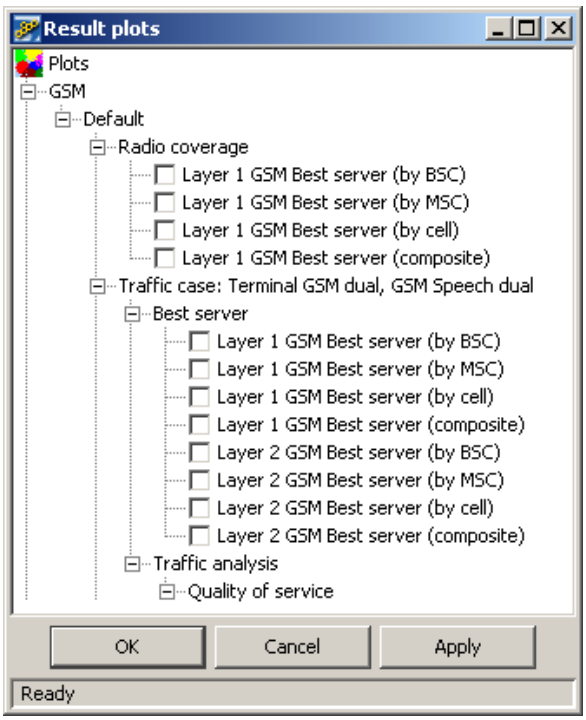
About Plots

For generic information about plots, read chapter *Plots* in the *TEMS CellPlanner Common Features User's Guide*.

The GSM result plots selection window opened from **Analysis↗Result plots** might look as in the following example:


Result plots
Plots
GSM
Default
Radio coverage
Layer 1 GSM Best server (by BSC)
Layer 1 GSM Best server (by MSC)
Layer 1 GSM Best server (by cell)
Layer 1 GSM Best server (composite)
Traffic case: Terminal GSM dual, GSM Speech dual
Best server
Layer 1 GSM Best server (by BSC)
Layer 1 GSM Best server (by MSC)
Layer 1 GSM Best server (by cell)
Layer 1 GSM Best server (composite)
Layer 2 GSM Best server (by BSC)
Layer 2 GSM Best server (by MSC)
Layer 2 GSM Best server (by cell)
Layer 2 GSM Best server (composite)
Traffic analysis
Quality of service
OK
Cancel
Apply
Ready

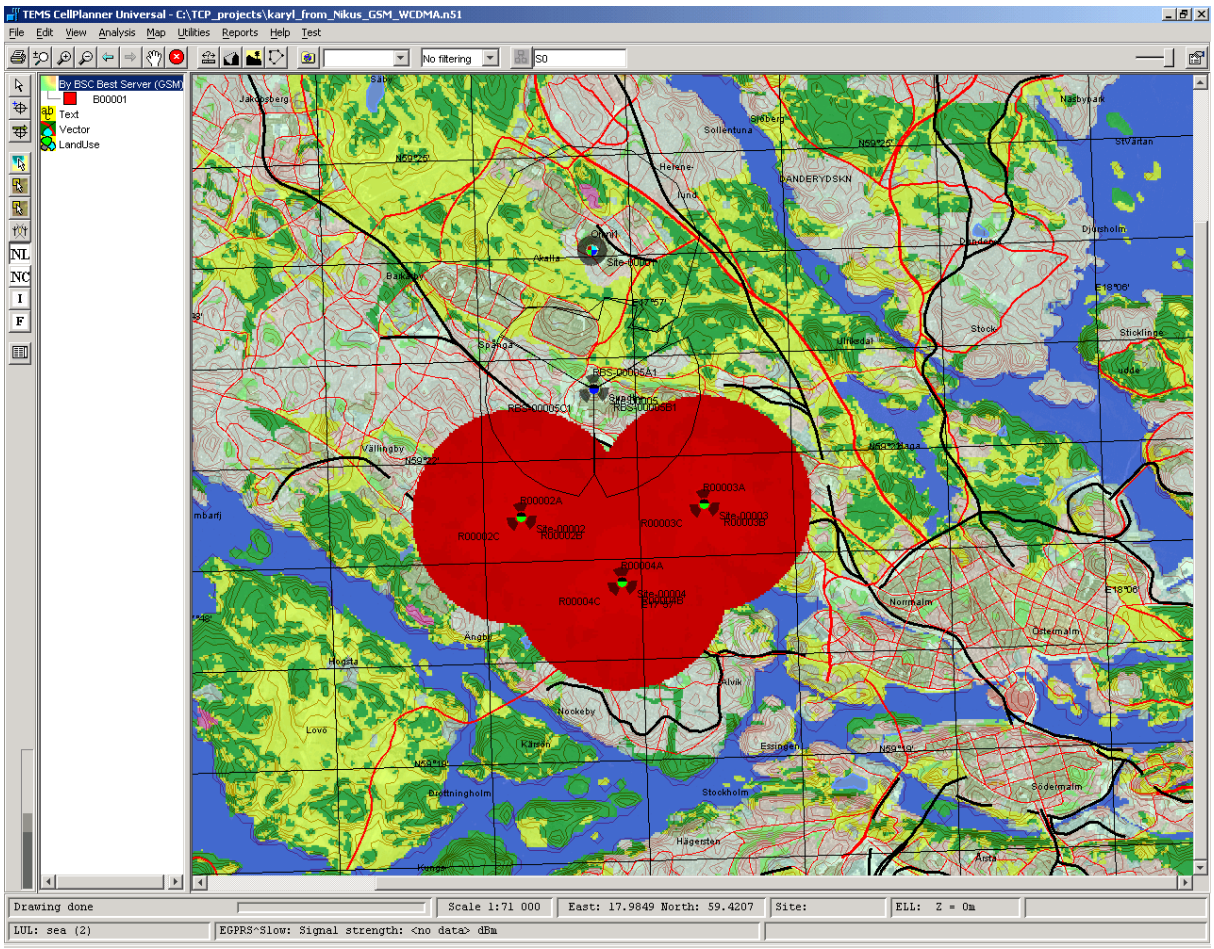
Best Server Plots

The following GSM best server plots can be generated:

- GSM Best Server Radio Coverage (by BSC, by cell or composite)
- GSM Best Server Layer N (by BSC, by cell or composite)
  The DL coverage of the very best, 2nd best, 3rd best server and so on.
  The upper limit is given by parameter **Depth of best server list** in the **GSM best server analysis** window.

GSM Best Server Radio Coverage (By BSC)

The figure below shows an example of the coverage of the best server (by BSC):



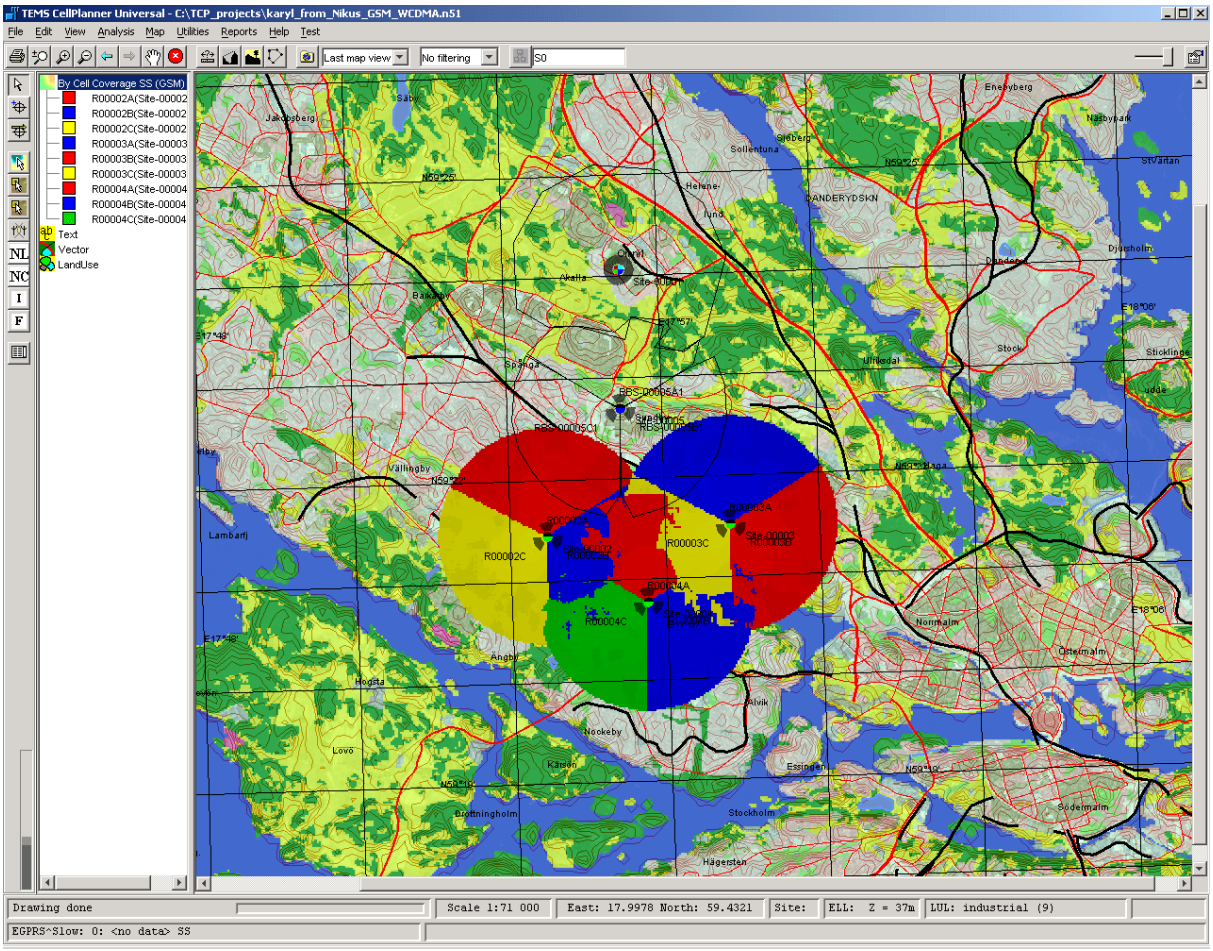
GSM Best Server Radio Coverage (By Cell)

The Coverage by Cell plot assigns a specific color to the whole coverage area of each cell. The coverage area means all bins in which the cell gives the strongest received signal.

The status bar below the map window shows the signal strength for the strongest cell (or underlaid sub-cell, if overlaid sub-cells are used).

The ranking of cells by signal strength is called *basic ranking*.

The figure below shows an example of the coverage of the best server (by cell):



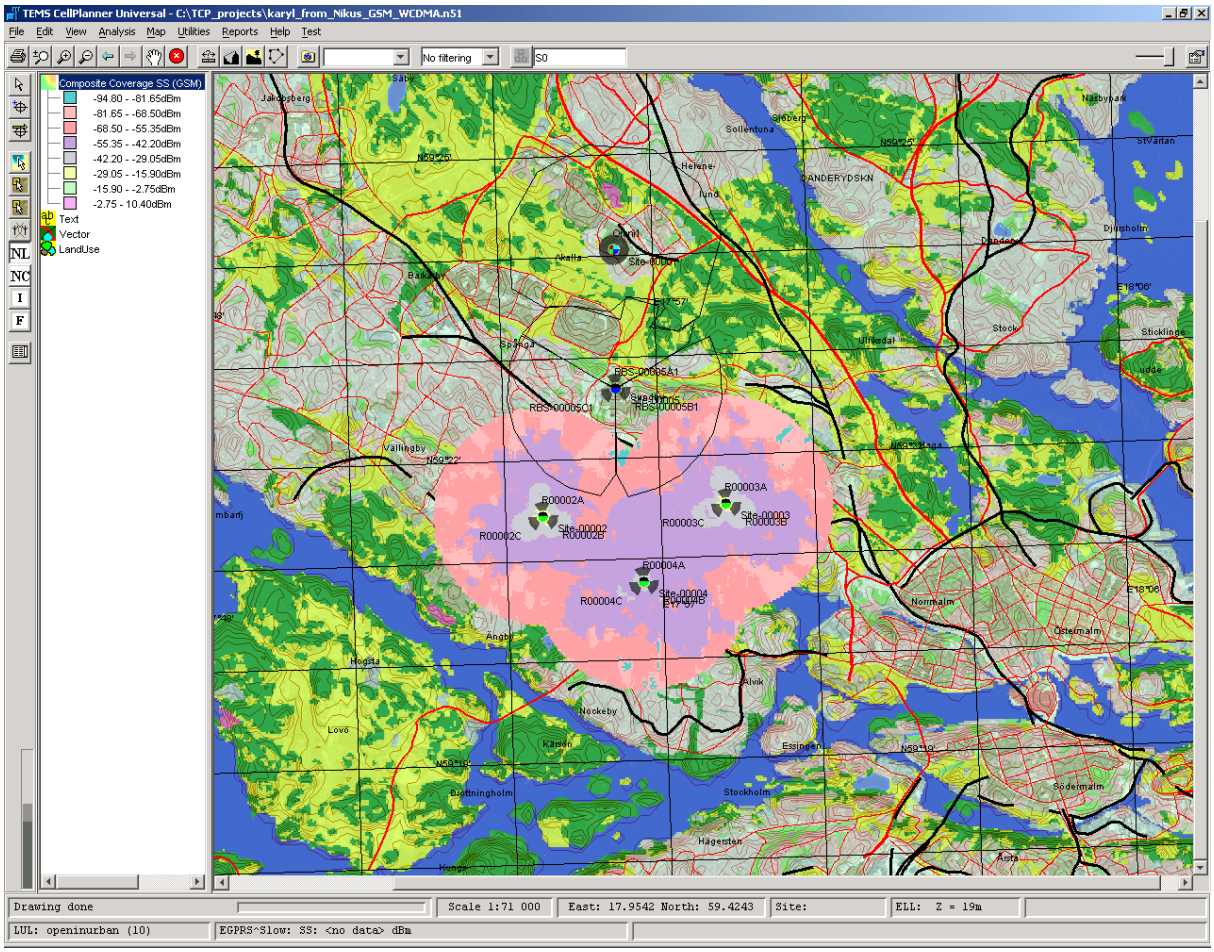
Note: *If you have selected a low resolution for the pathloss prediction, some clutter codes may have zero area in the coverage plot, although they can still be seen in the map display. This occurs because a land use code is represented only in a small part of each bin.*

GSM Best Server Radio Coverage (Composite)

The Coverage (Composite) plot assigns a specific color to all bins with a certain signal strength from the strongest cell.

The status bar below the map window shows the signal strength for the strongest cell (or underlaid sub-cell, if overlaid sub-cells are used).

The figure below shows an example of the coverage the best server (composite):



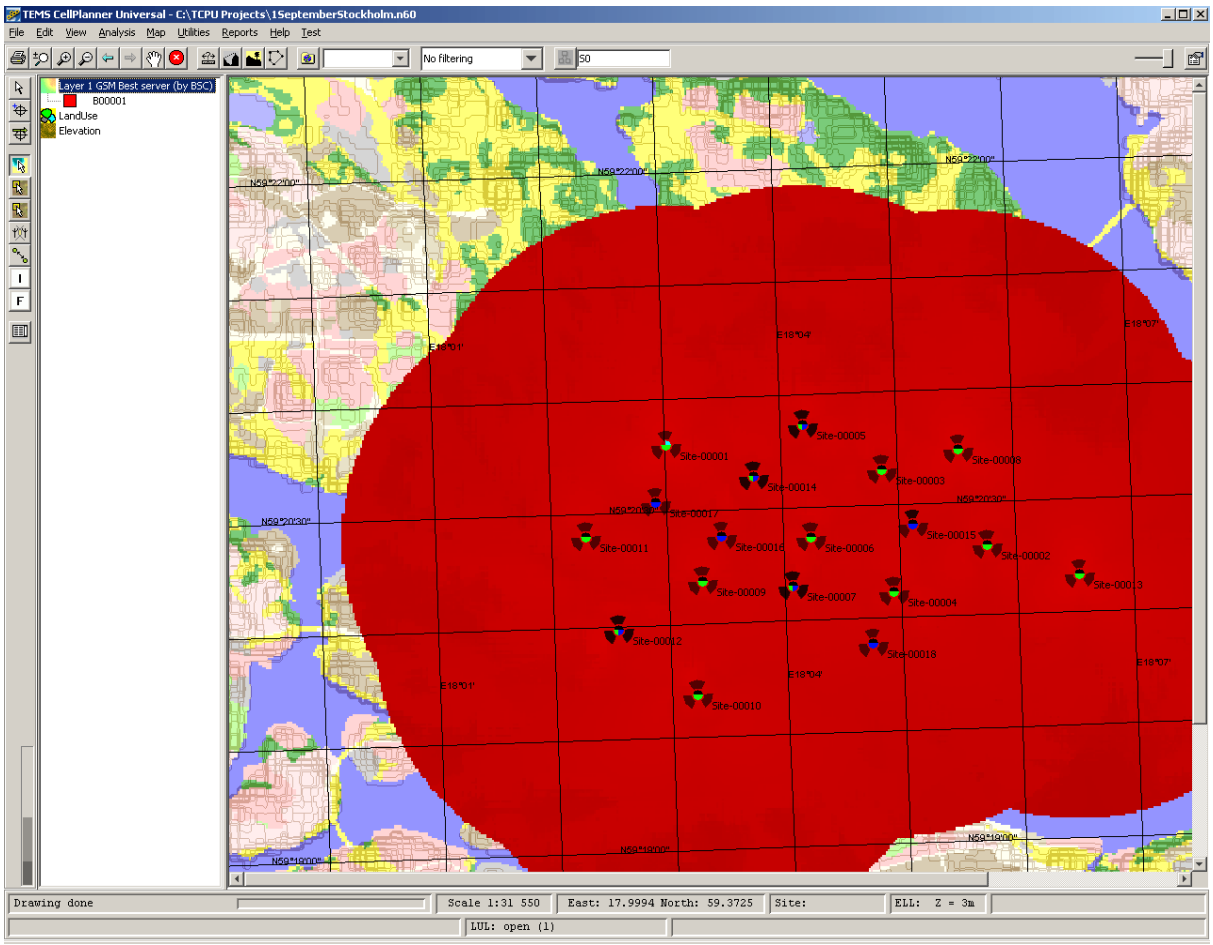
GSM Best Server Layer 1 (By BSC)

The Best Server Layer 1 (by BSC) plot assigns a specific color to the whole coverage area of all best serving cells connected to each BSC.

The status bar below the map window shows the identity of the BSC and serving cell, plus the signal strength for the best serving cell, or for underlaid or overlaid sub-cell, where applicable.

For all Best Server Layer plots, HCS bands and layers are considered when applicable. The cell with lowest HCS layer number can be Best Server, although it is not the strongest cell, as long as its signal strength exceeds its HCS layer threshold.

The figure below shows an example of a best server plot (by BSC), of the very best server:



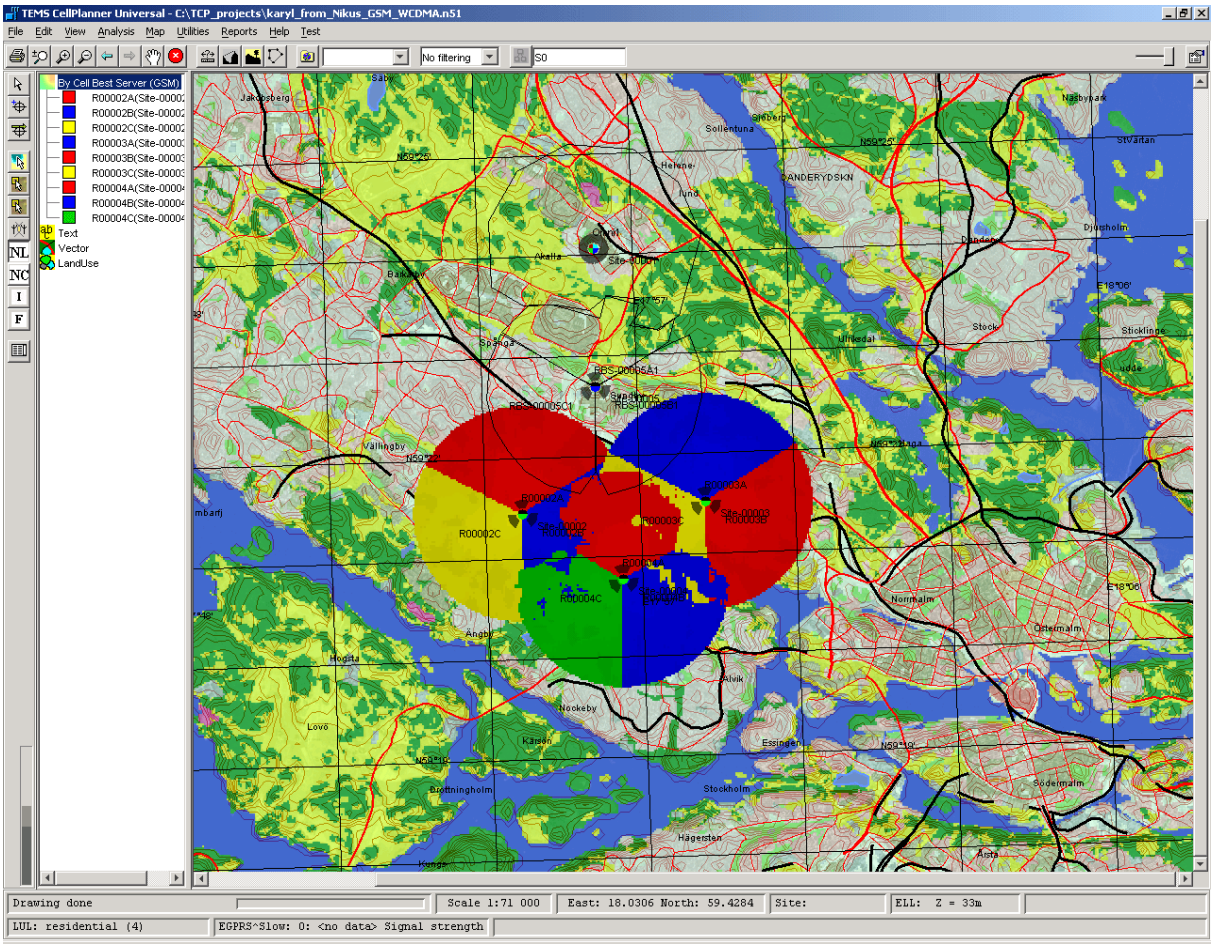
GSM Best Server Layer 1 (By Cell)

The Best Server Layer 1 (by Cell) plot assigns a specific color to the whole coverage area of all best serving cells, and to the coverage area of each underlaid and overlaid sub-cell, where applicable.

The status bar below the map window shows the identity of the serving cell plus the signal strength for the best serving cell, or for underlaid and overlaid sub-cell, where applicable.

For all Best Server Layer plots, HCS bands and layers are considered when applicable. The cell with lowest HCS layer number can be Best Server, although it is not the strongest cell, as long as its signal strength exceeds its HCS layer threshold

The figure below shows an example of a best server plot (by cell), of the very best server:

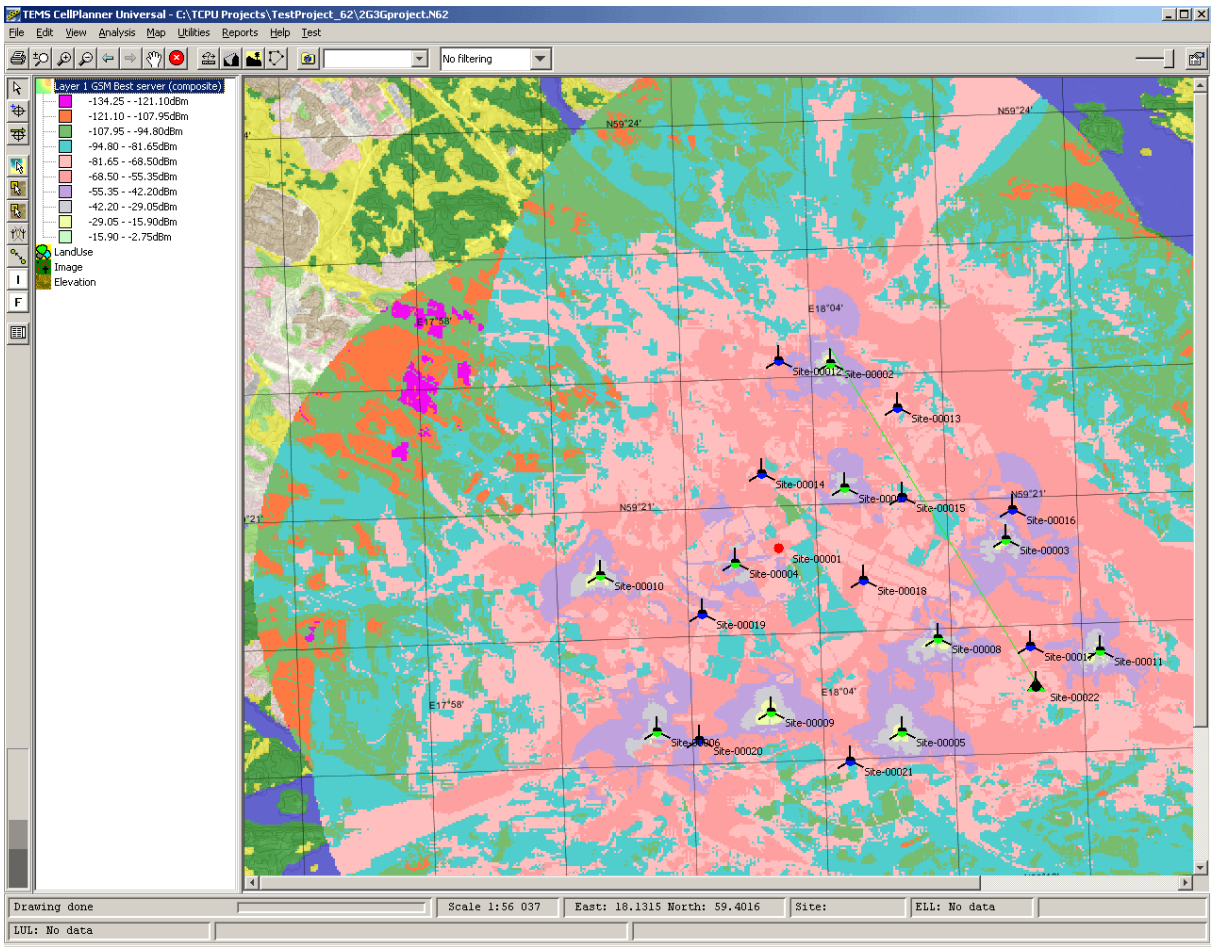


GSM Best Server Layer 1 (Composite)

The Best Server Layer 1 (Composite) plot assigns a specific color to all bins with a certain signal strength from the best serving cell. The status bar below the map window shows the signal strength for the best serving cell, or for underlaid and overlaid sub-cell, where applicable.

For all Best Server Layer plots, HCS bands and layers are considered when applicable. The cell with lowest HCS layer number can be Best Server, although it is not the strongest cell, as long as its signal strength exceeds its HCS layer threshold

The figure below shows an example of a best server plot (composite), of the very best server:



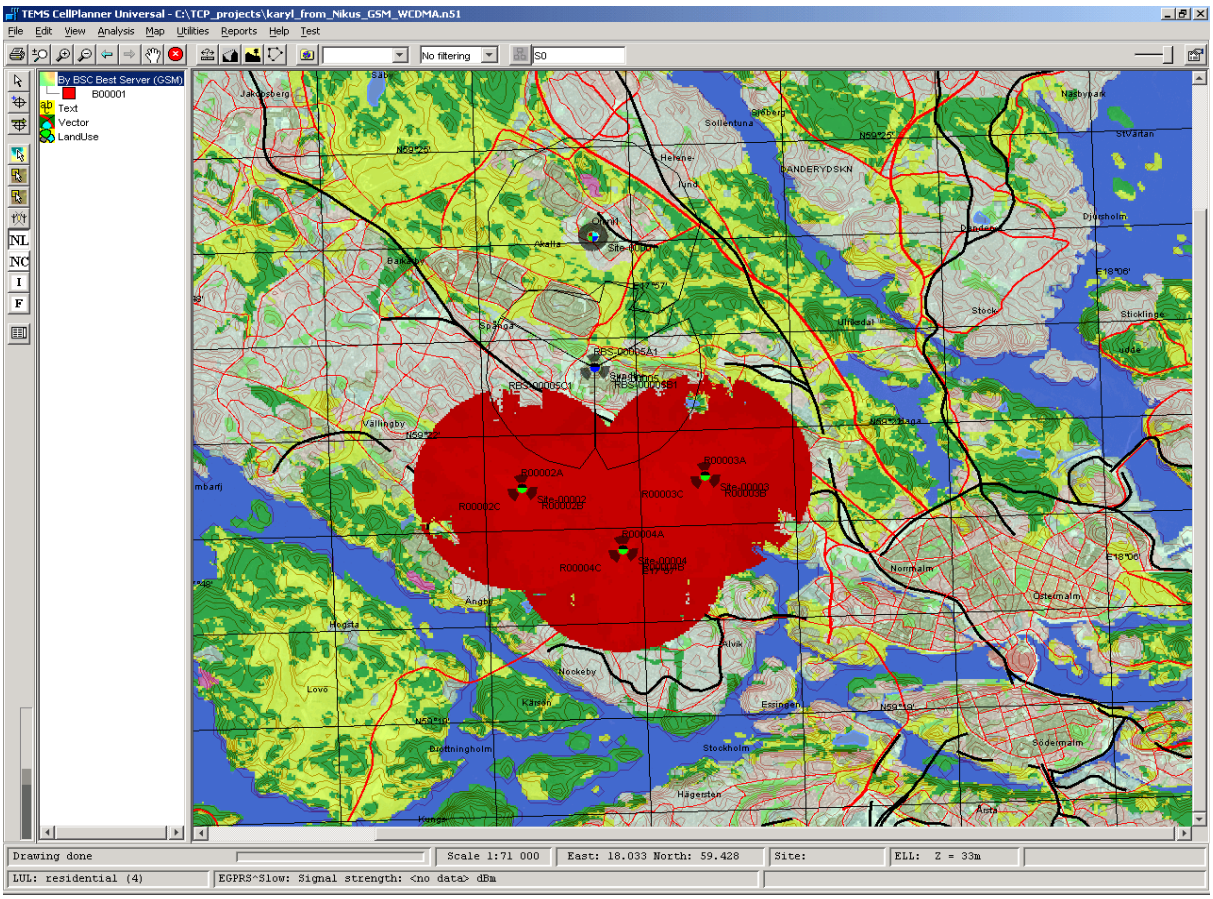
GSM Best Server Layer 2 (By BSC)

The Best Server Layer 2 (by BSC) plot assigns a specific color to the whole coverage area of all second-best serving cells connected to each BSC.

The status bar below the map window shows the signal strength for the second-best serving cell, or for underlaid or overlaid sub-cell, where applicable.

For all Best Server Layer plots, HCS bands and layers are considered when applicable. The cell with lowest HCS layer number can be Best Server, although it is not the strongest cell, as long as its signal strength exceeds its HCS layer threshold.

The figure below shows an example of a best server plot (by BSC), of the 2nd best server:



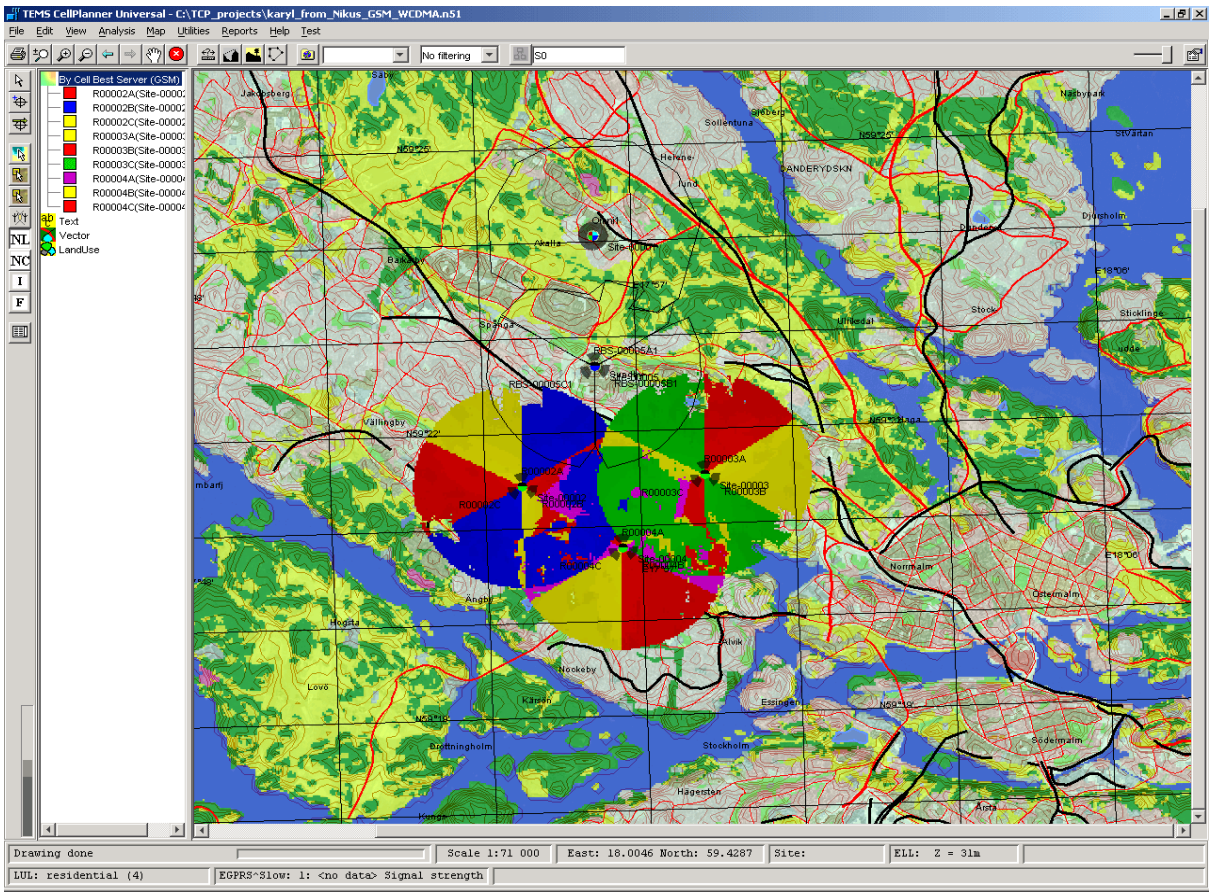
GSM Best Server Layer 2 (By Cell)

The Best Server Layer 2 (by cell) plot assigns a specific color to the whole coverage area of all second-best serving cells, and to the coverage area of each underlaid and overlaid sub-cell, where applicable.

The status bar below the map window shows the signal strength for the second-best serving cell, or for underlaid or overlaid sub-cell, where applicable.

For all Best Server Layer plots, HCS bands and layers are considered when applicable. The cell with lowest HCS layer number can be Best Server, although it is not the strongest cell, as long as its signal strength exceeds its HCS layer threshold.

The figure below shows an example of a best server plot (by cell), of the 2nd best server:

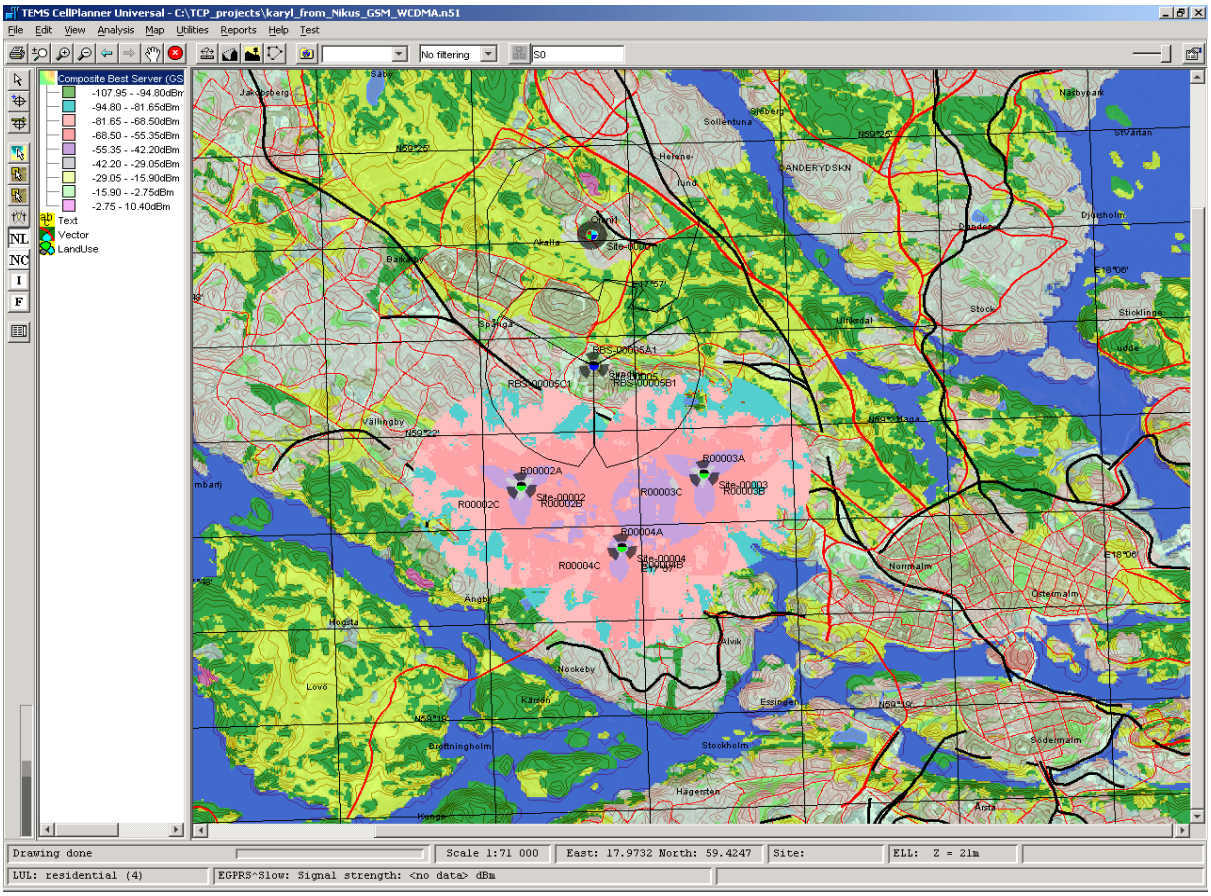


GSM Best Server Layer 2 (Composite)

The Best Server Layer 2 (composite) plot assigns a specific color to all bins with a certain signal strength from the second-best serving cell. The status bar below the map window shows the signal strength for the second best serving cell, or for underlaid or overlaid sub-cell, where applicable.

For all Best Server Layer plots, HCS bands and layers are considered when applicable. The cell with lowest HCS layer number can be Best Server, although it is not the strongest cell, as long as its signal strength exceeds its HCS layer threshold.

The figure below shows an example of a best server plot (composite), of the 2nd best server:



Traffic Performance Plots

The traffic performance plots can be color coded in two ways:

- by cell - each cell is identified by a specific color
- composite - the cell's coverage area is identified by a specific value

When you place the cursor on a bin, the plotted value in that bin is displayed on the status bar.

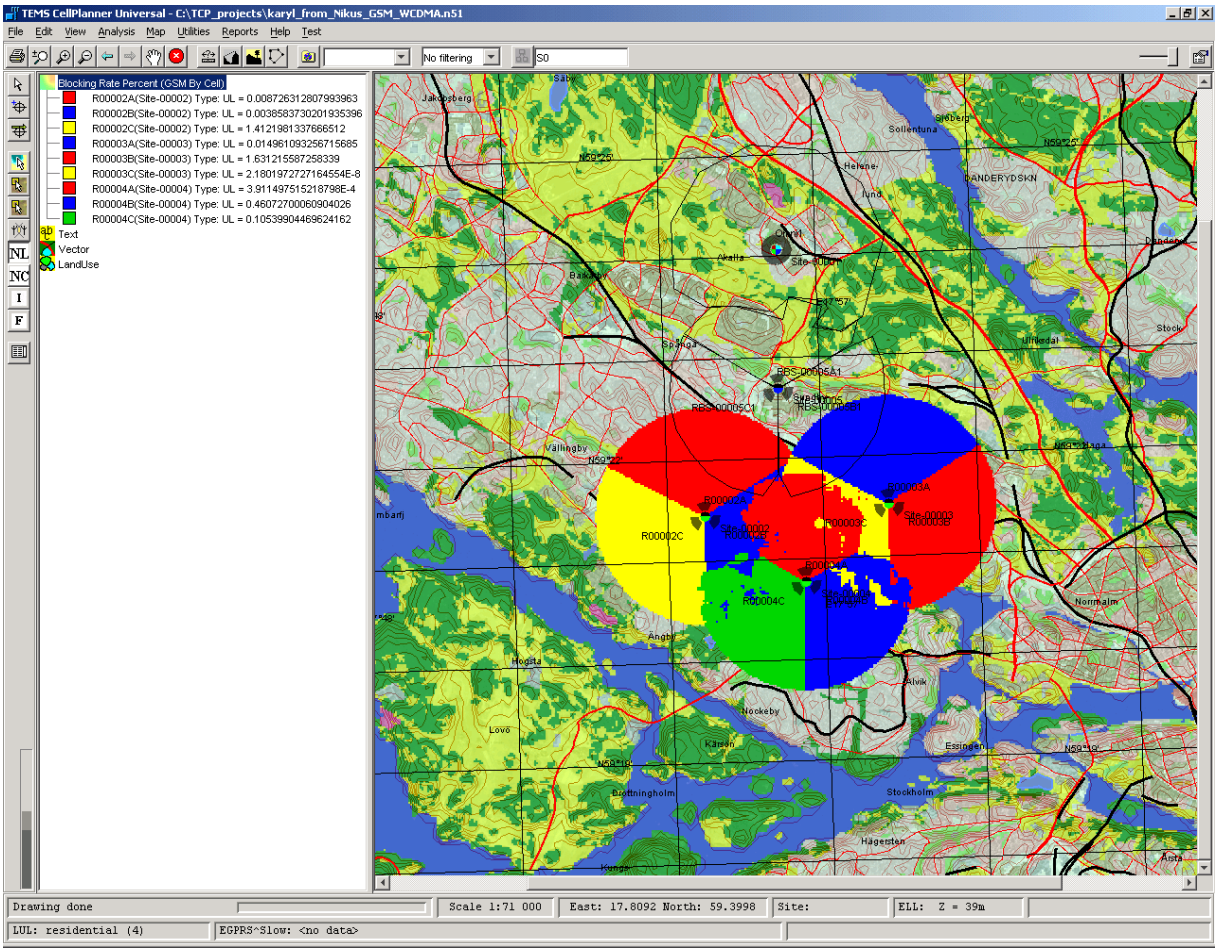
The following GSM traffic performance plots can be generated:

• Blocking Rate (By Cell) • Blocking Rate (Composite)	Percentage of blocked CS calls
• CS Traffic (By Cell) • CS Traffic (Composite)	Amount of CS traffic
• Current TRX (By Cell) • Current TRX (Composite)	Number of TRXs currently assigned per cell
• Required TRX (By Cell) • Required TRX (Composite)	Number of TRXs required per cell
• Delta TRX (By Cell) • Delta TRX (Composite)	Difference between required and assigned number of TRXs
• Current ETRX (By Cell) • Current ETRX (Composite)	Number of EDGE capable TRXs currently assigned per cell
• Required ETRX (By Cell) • Required ETRX (Composite)	Number of EDEGE capable TRXs required per cell
• Delta ETRX (By Cell) • Delta ETRX (Composite)	Difference between required and assigned number of EDGE capable TRXs
• GPRS Throughput per Timeslot (By Cell) • EDGE Evolution Throughput per Timeslot (Composite)	
• GPRS Throughput per Timeslot (By Cell) • GPRS Throughput per Timeslot (Composite)	
• EGPRS Throughput per Timeslot (By Cell) • EGPRS Throughput per Timeslot (Composite)	
• EDGE Evolution Traffic (By Cell) • EDGE Evolution Traffic (Composite)	

- GPRS Traffic (By Cell)
- GPRS Traffic (Composite)
- EGPRS Traffic (By Cell)
- EGPRS Traffic (Composite)

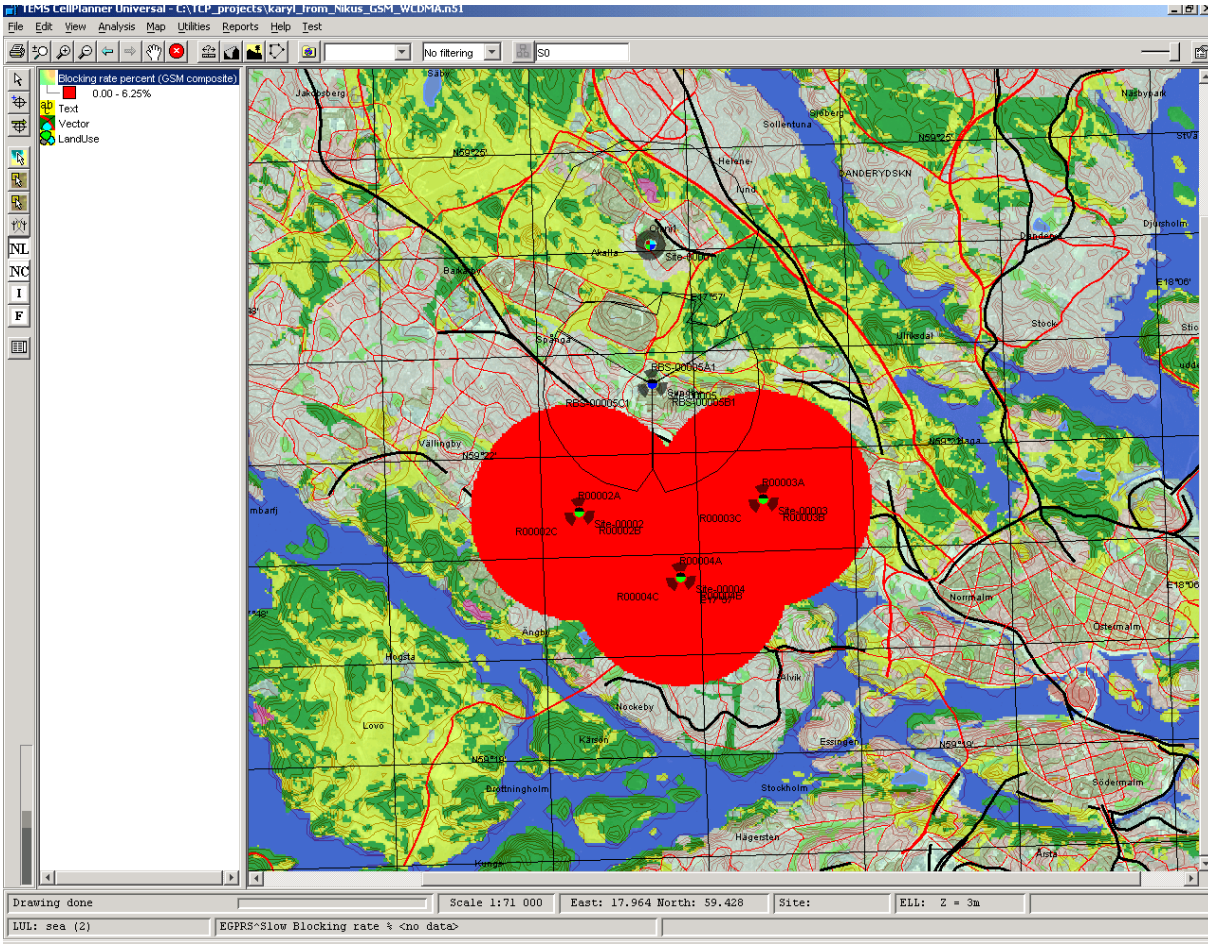
Blocking Rate (By Cell)

The figure below shows an example of a blocking rate plot (by cell):



Blocking Rate (Composite)

The figure below shows an example of a blocking rate plot (composite), showing the blocking rate per the cell's coverage area:



EDGE Evolution Throughput per Timeslot (By Cell)

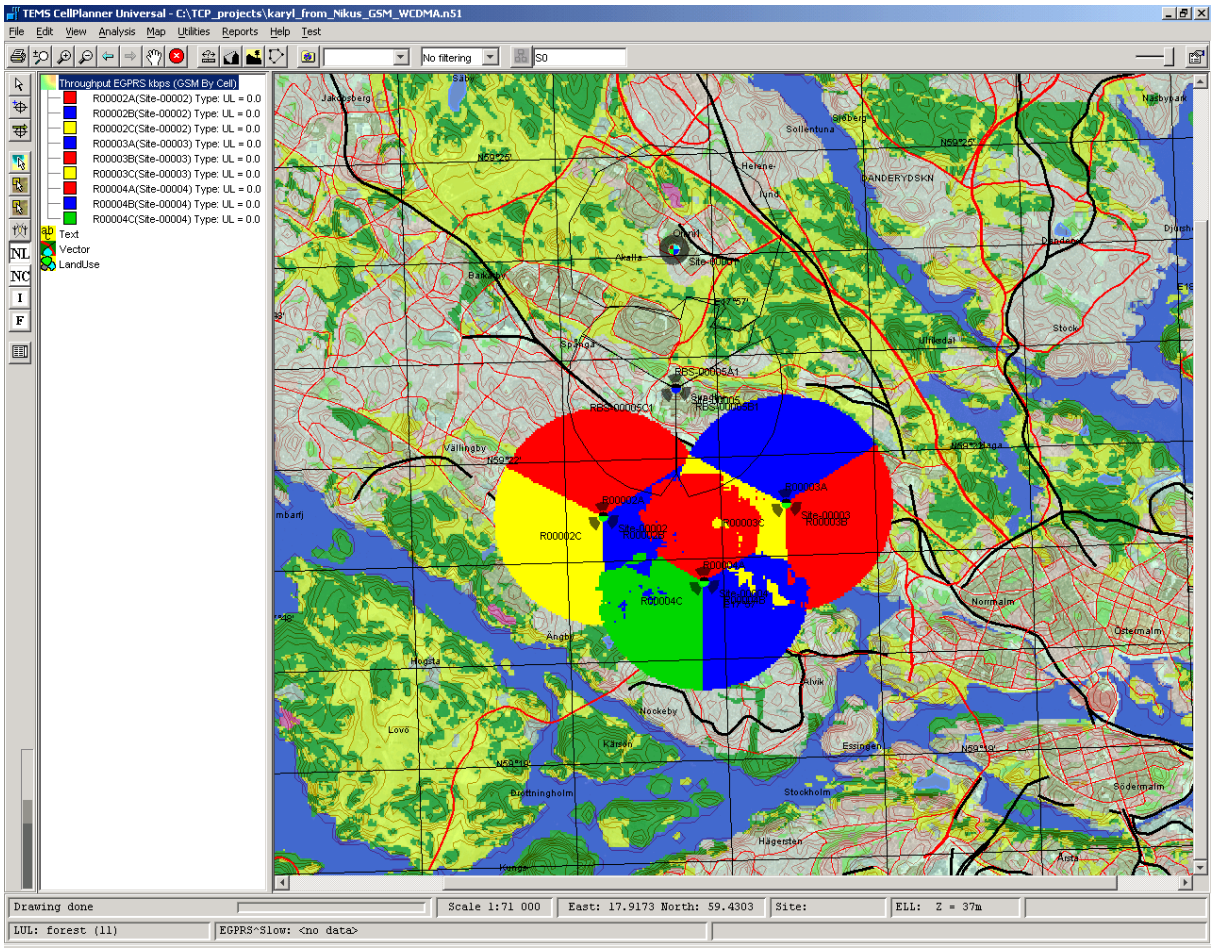
The EDGE Evolution throughput (by cell) plot displays the amount of EDGE Evolution traffic per TS, color coded by best serving cell.

EDGE Evolution Throughput per Timeslot (Composite)

The EDGE Evolution throughput plot displays the amount of EDGE Evolution traffic per TS, color coded by value.

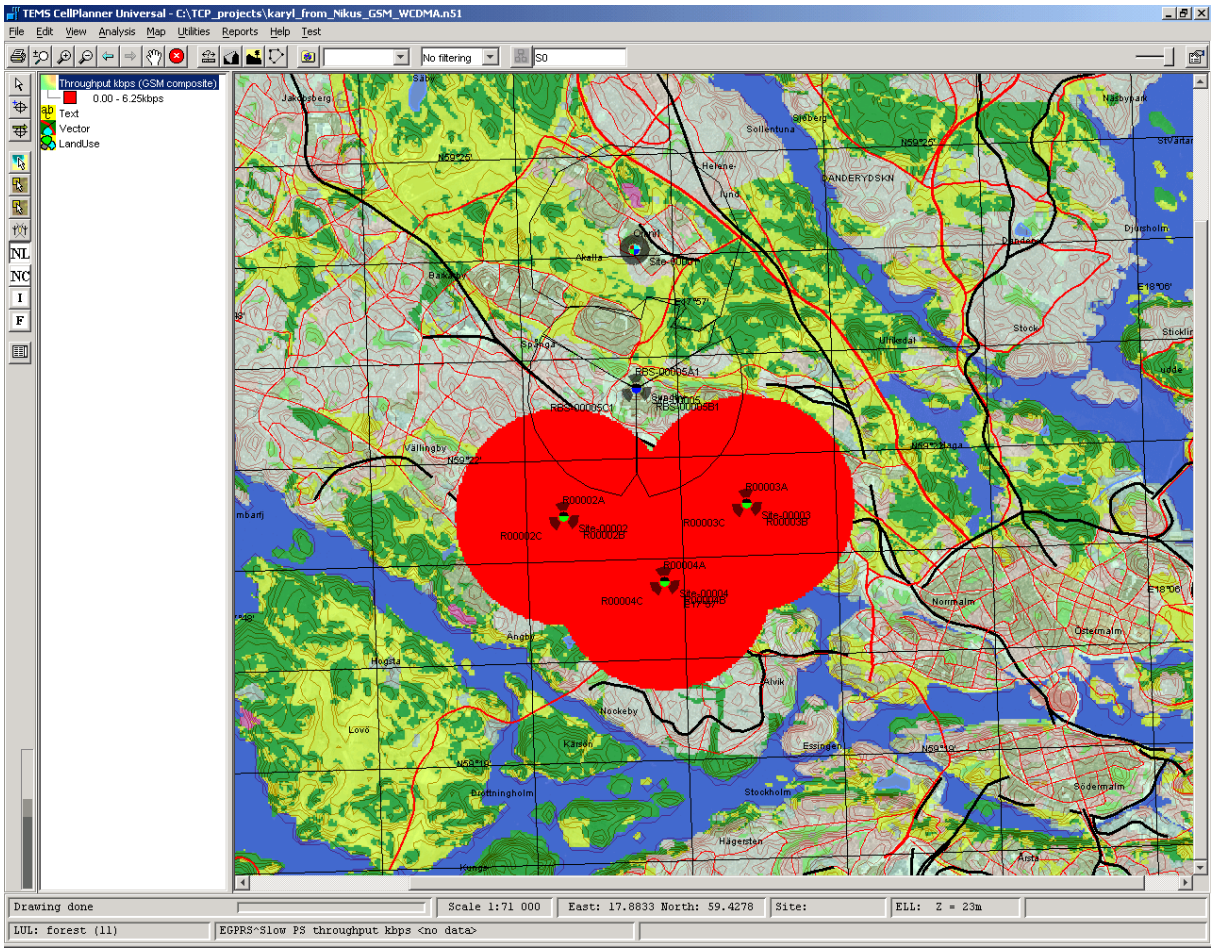
EGPRS Throughput per Timeslot (By Cell)

The figure below shows an example of an EGPRS throughput plot (by cell), portraying the throughput for EGPRS per the cell's coverage area:



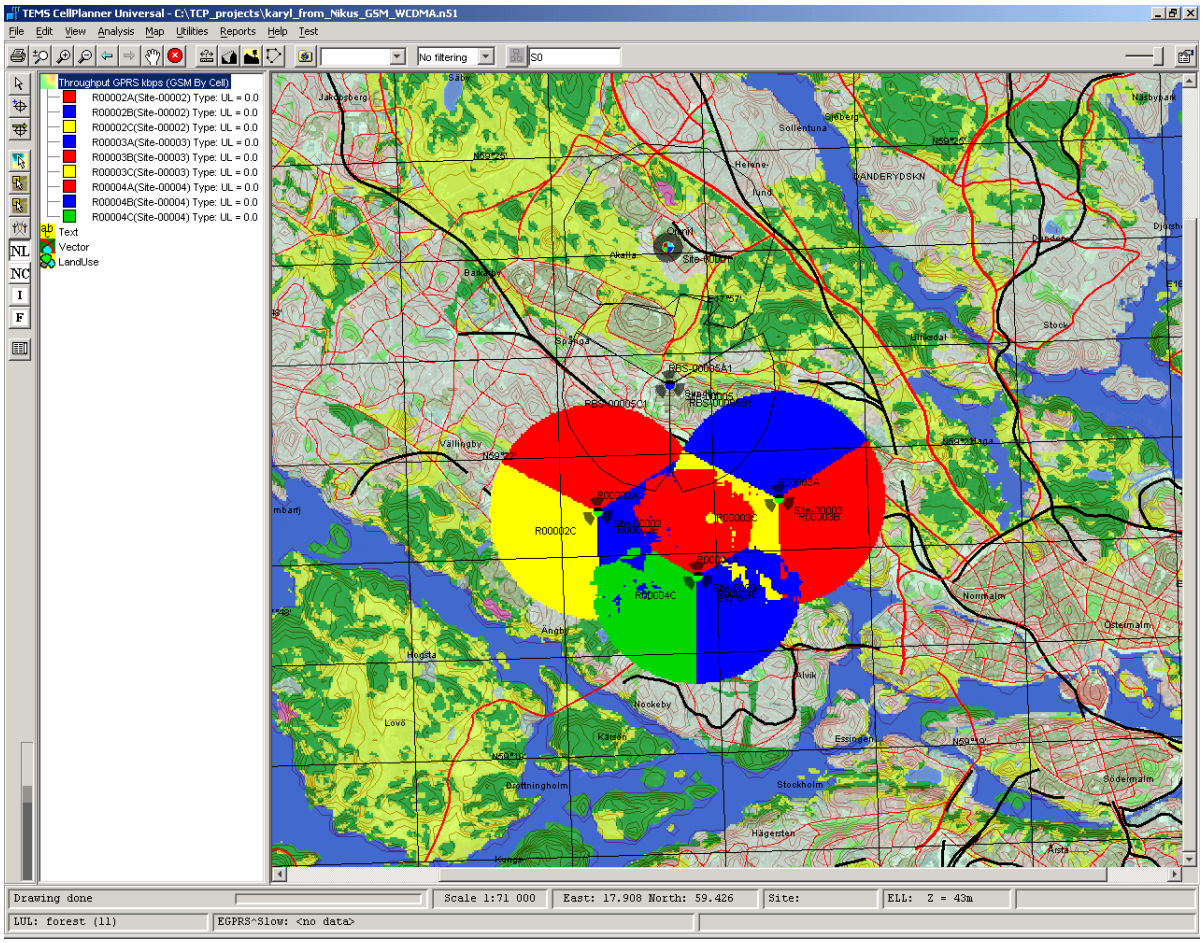
EGPRS Throughput per Timeslot (Composite)

The figure below shows an example of an EGPRS throughput plot (composite), portraying the EGPRS throughput for the composite coverage area:



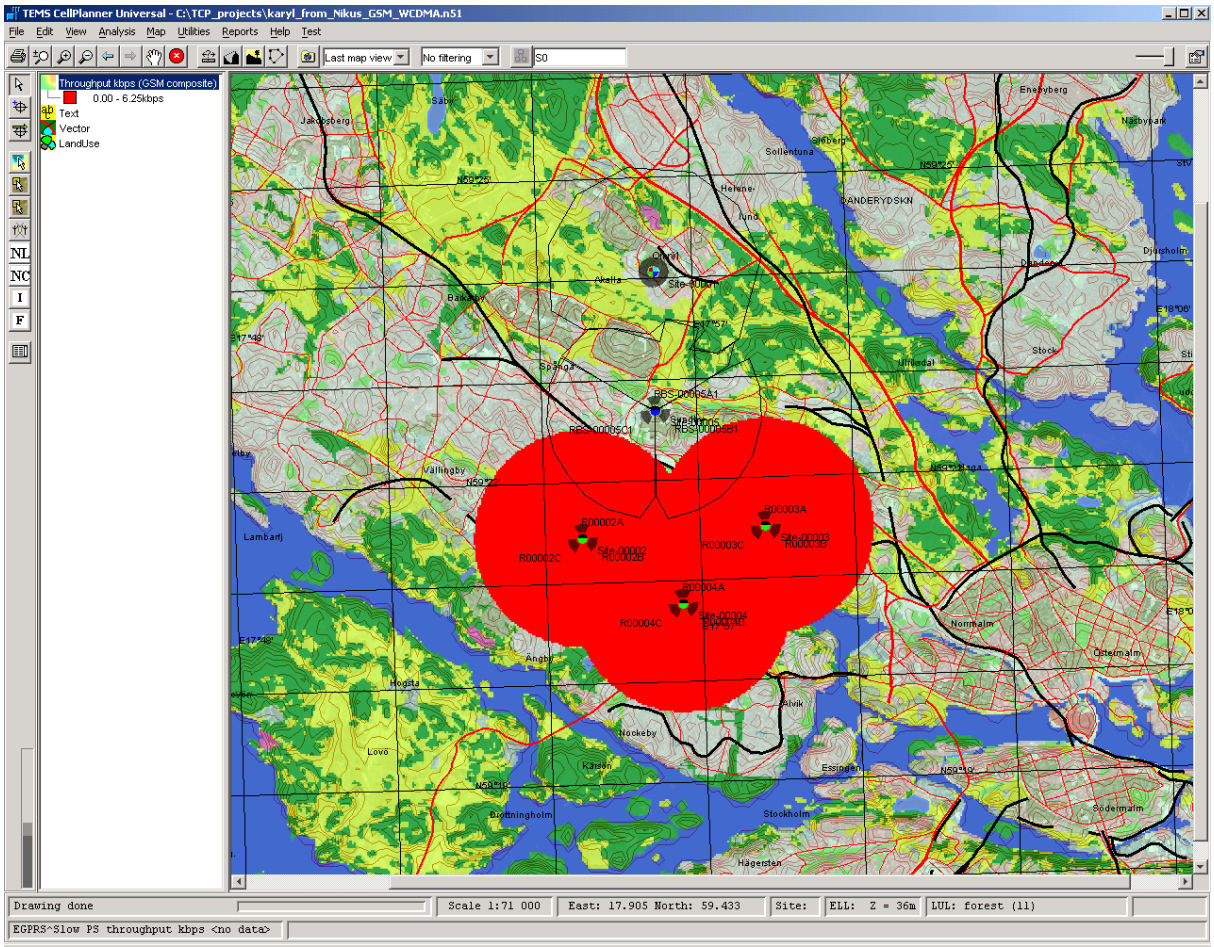
GPRS Throughput per Timeslot (By Cell)

The figure below shows an example of a GPRS throughput plot (by cell), portraying the GPRS throughput for the cell's coverage area:



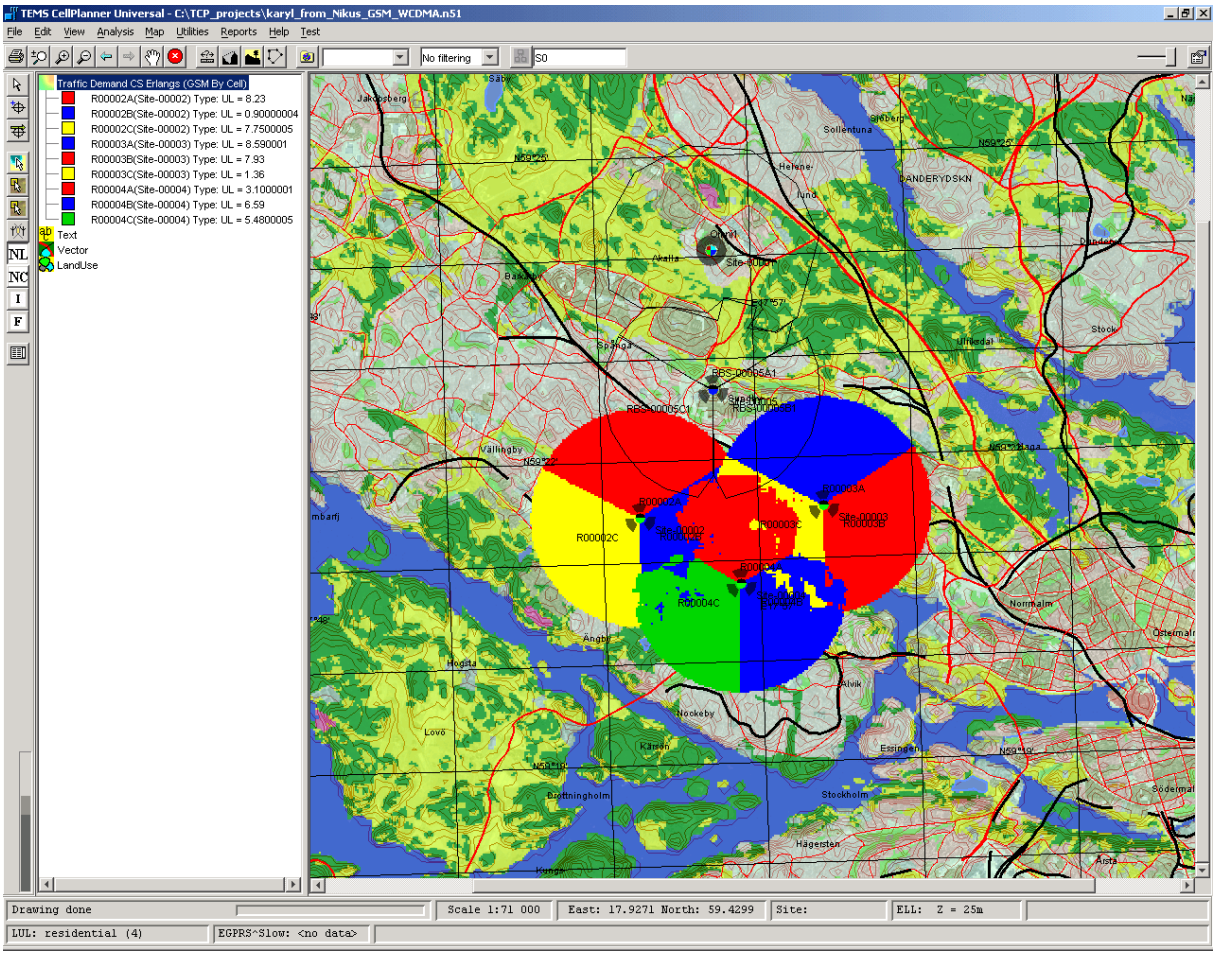
GPRS Throughput per Timeslot (Composite)

The figure below shows an example of a GPRS throughput plot (composite), portraying the GPRS throughput for the composite coverage area:



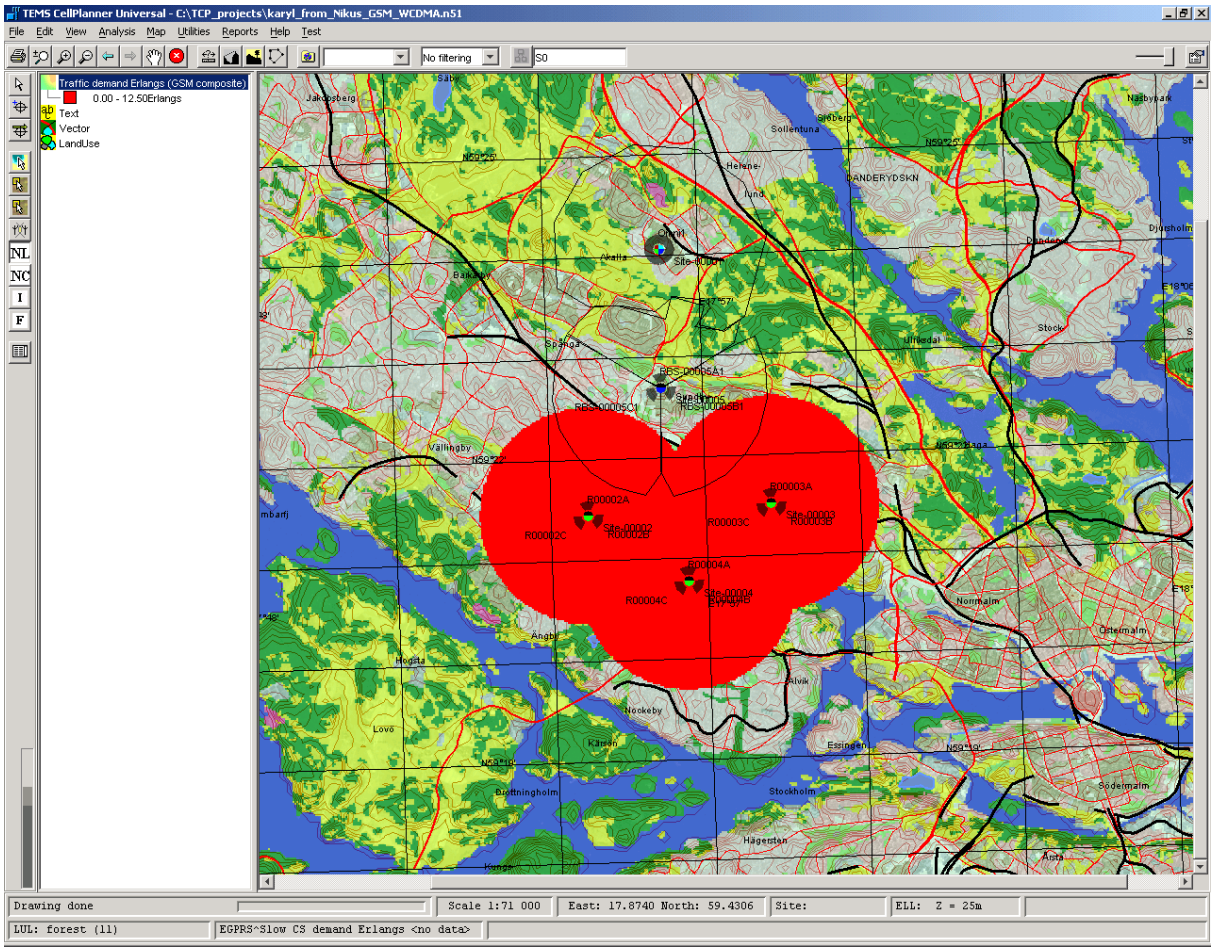
CS Traffic (By Cell)

The figure below shows an example of a circuit switched traffic plot (by cell), portraying the circuit switched traffic for the cell's coverage area:



CS Traffic (Composite)

The figure below shows an example of a circuit switched traffic plot (composite), portraying the circuit switched traffic for the composite coverage area:



EDGE Evolution Traffic (By Cell)

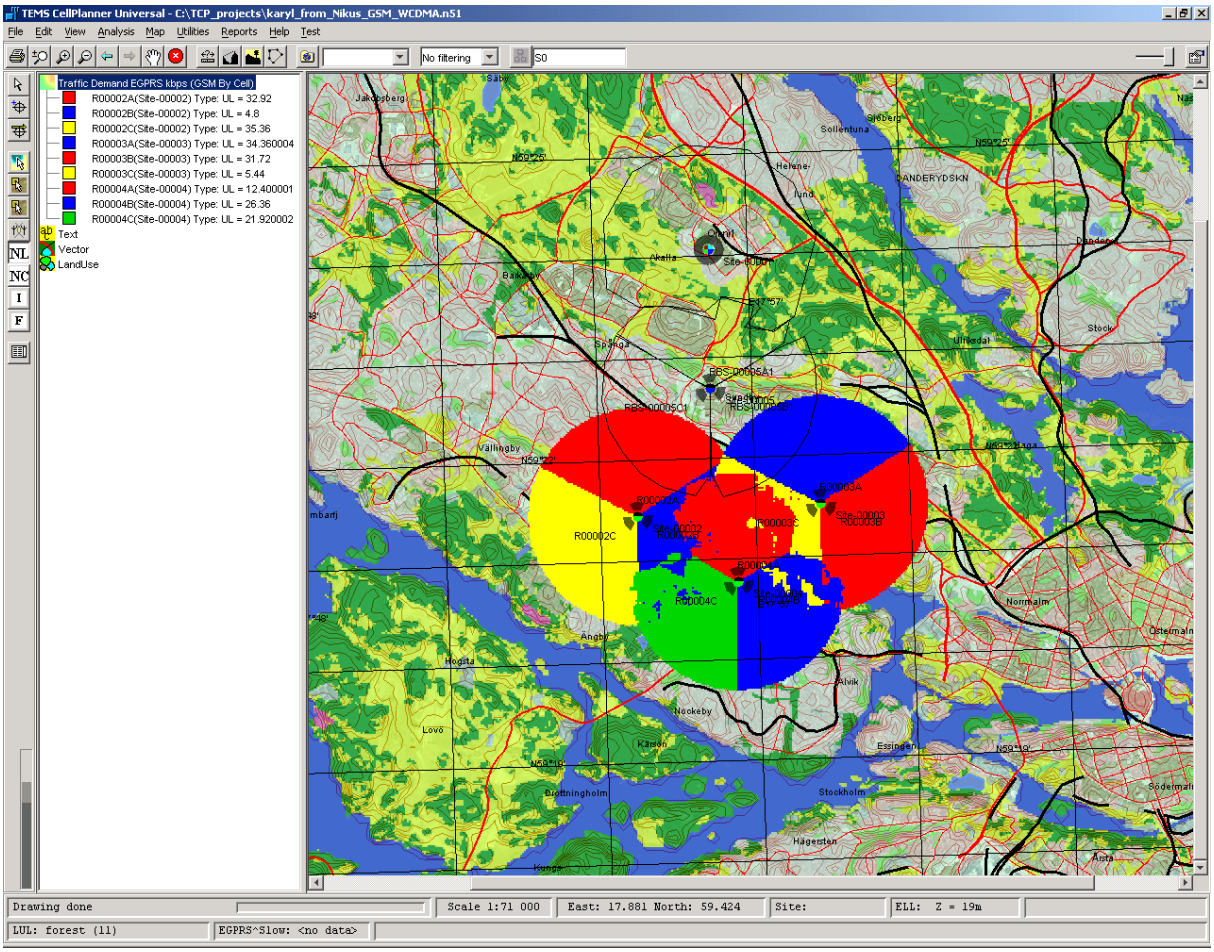
The EDGE evolution traffic (by cell) plot displays the amount of EDGE evolution traffic, color coded by best serving cell.

EDGE Evolution Traffic (Composite)

The EDGE evolution traffic (composite) plot displays the amount of EDGE evolution traffic, color coded by value.

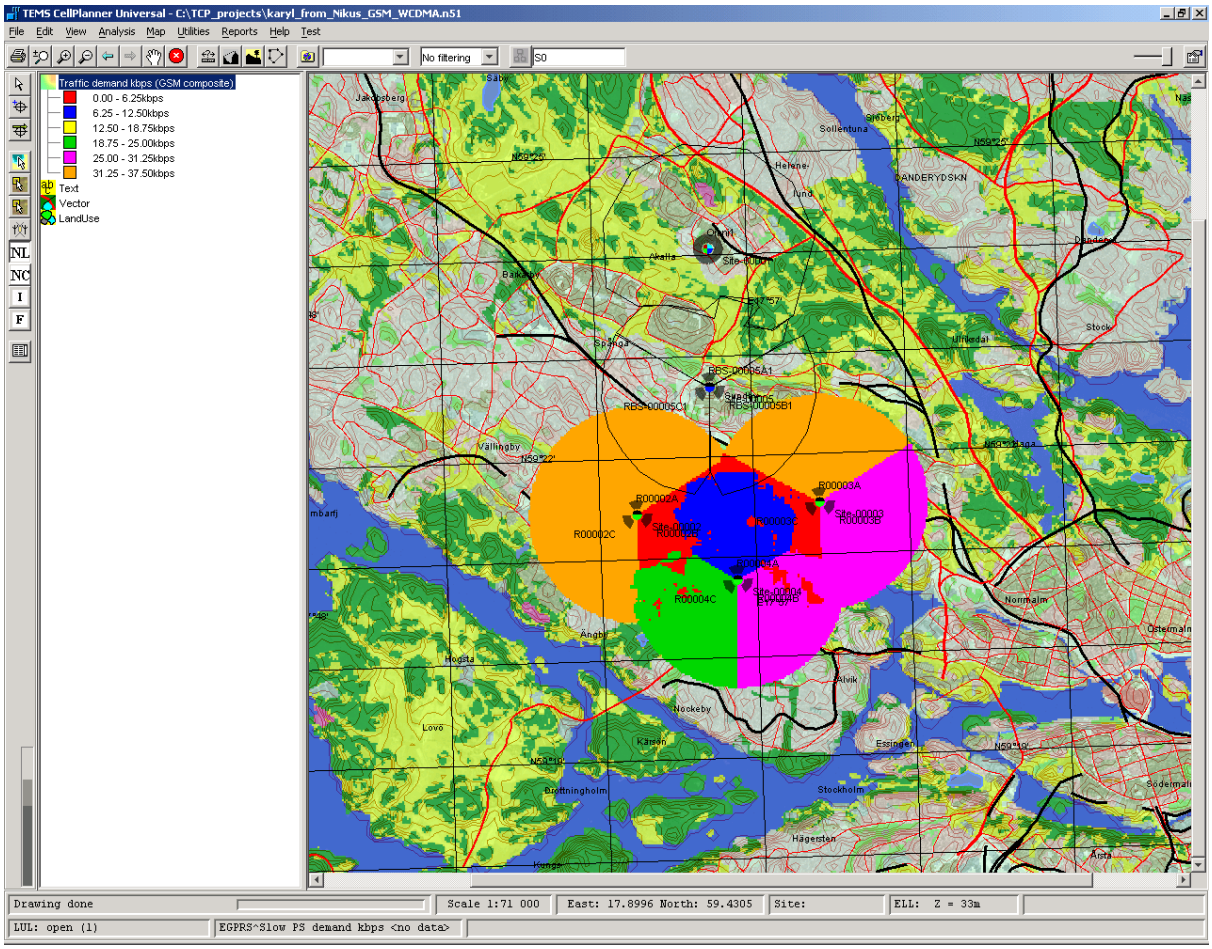
EGPRS Traffic (By Cell)

The figure below shows an example of an EGPRS traffic plot (by cell), portraying the EGPRS traffic for the cell's coverage area:



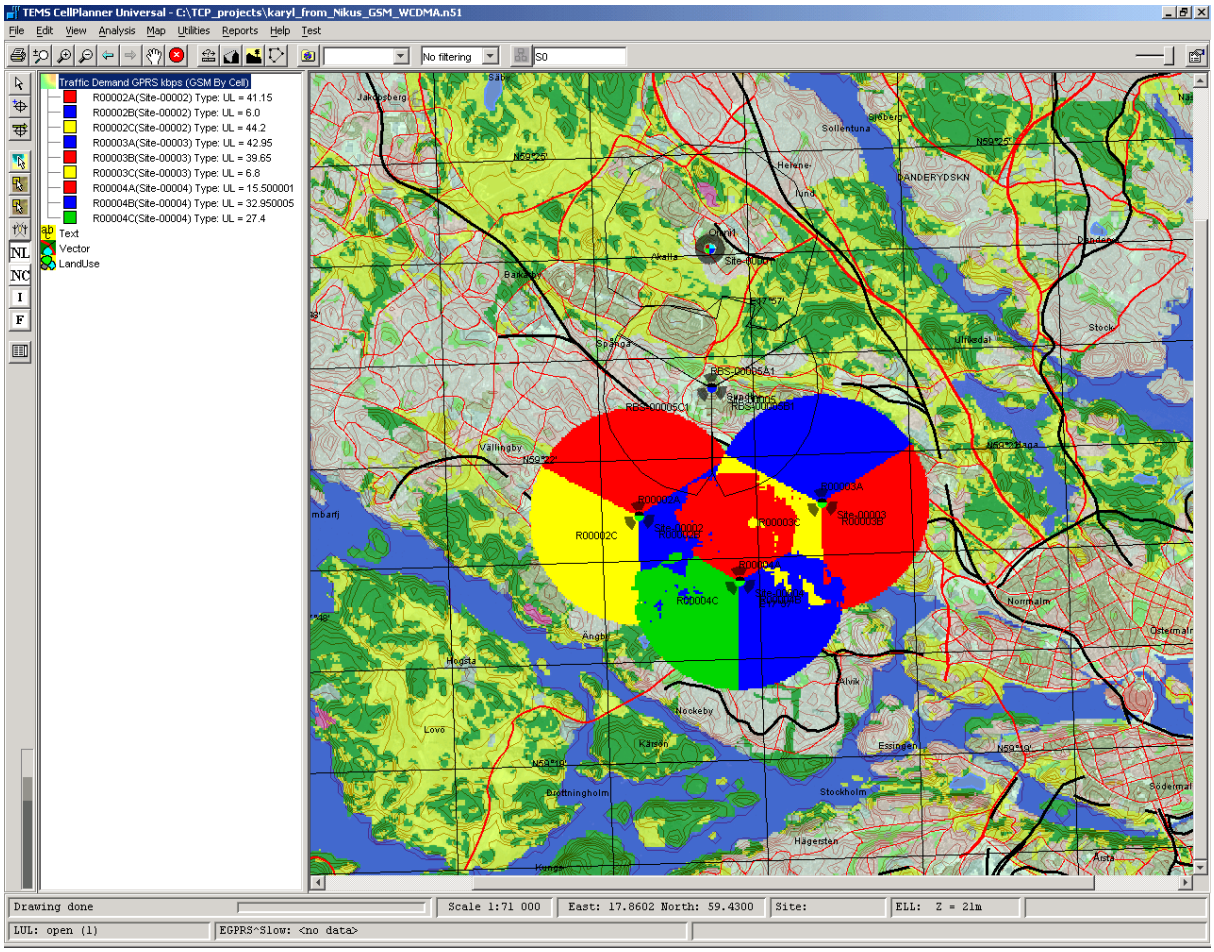
EGPRS Traffic (Composite)

The figure below shows an example of an EGPRS traffic plot (composite), portraying the EGPRS traffic for the composite coverage area:



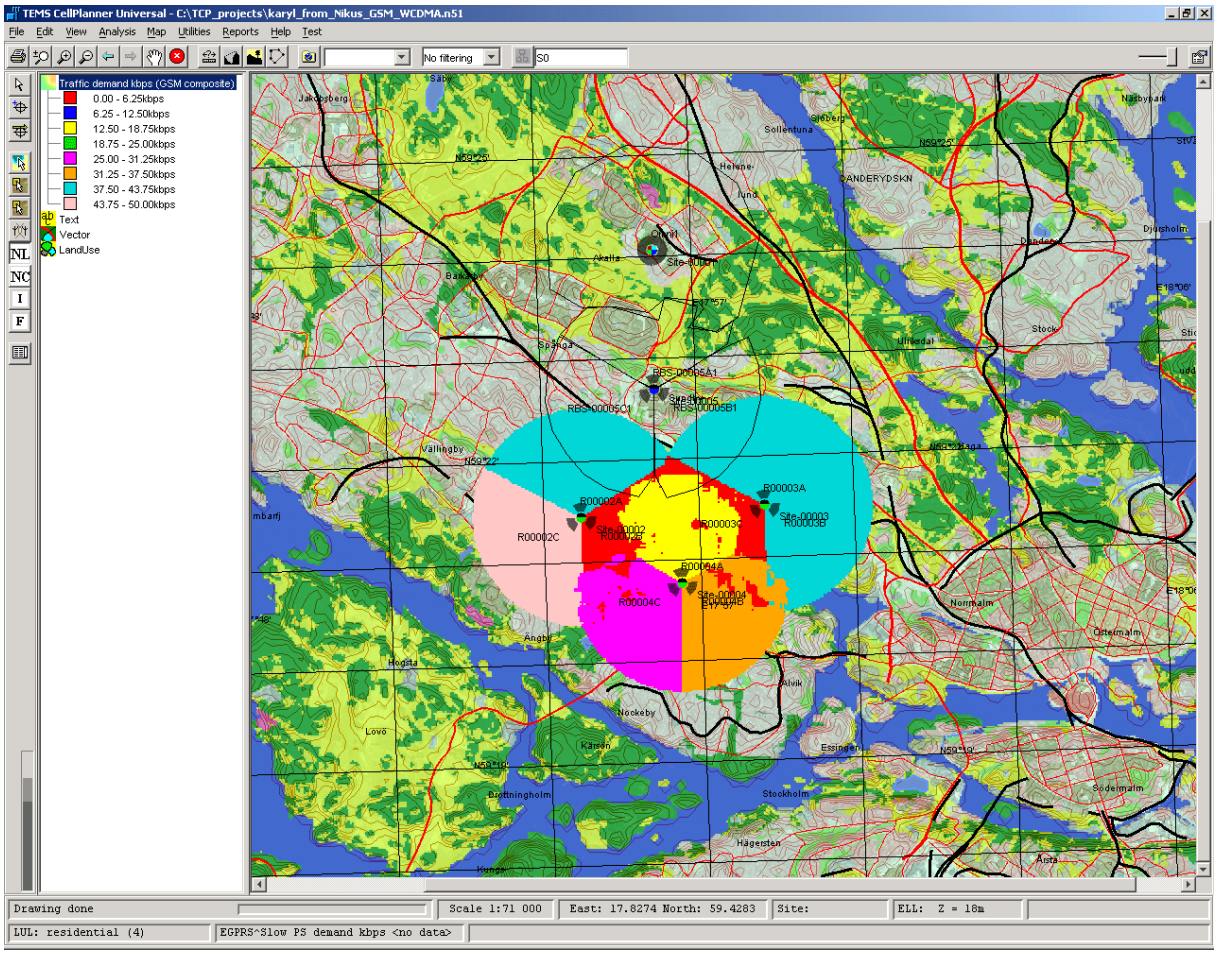
GPRS Traffic (By Cell)

The figure below shows an example of a GPRS traffic plot (by cell, portraying the GPRS traffic for the cell's coverage area:



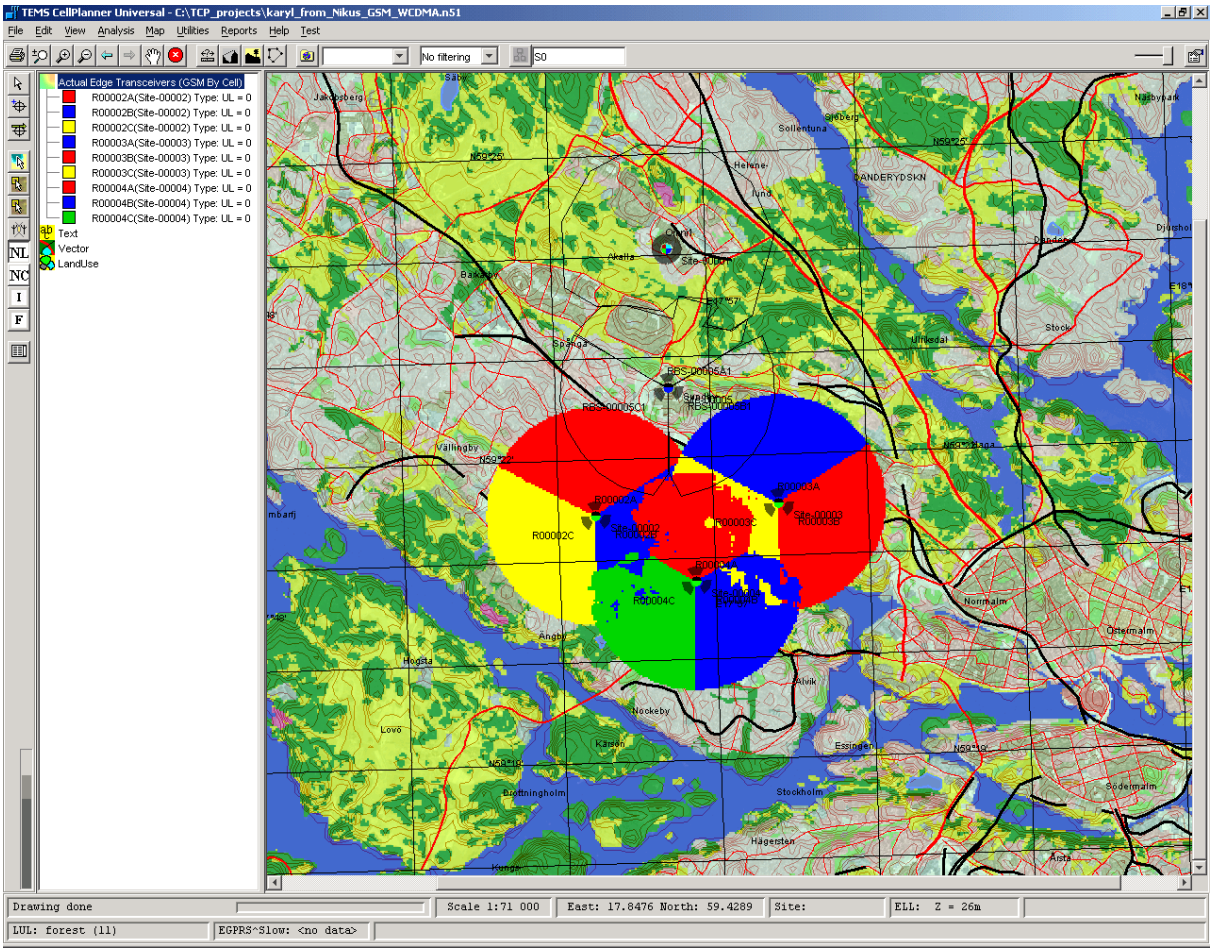
GPRS Traffic (Composite)

The figure below shows an example of a GPRS traffic plot (composite), portraying the GPRS traffic for the composite coverage area:



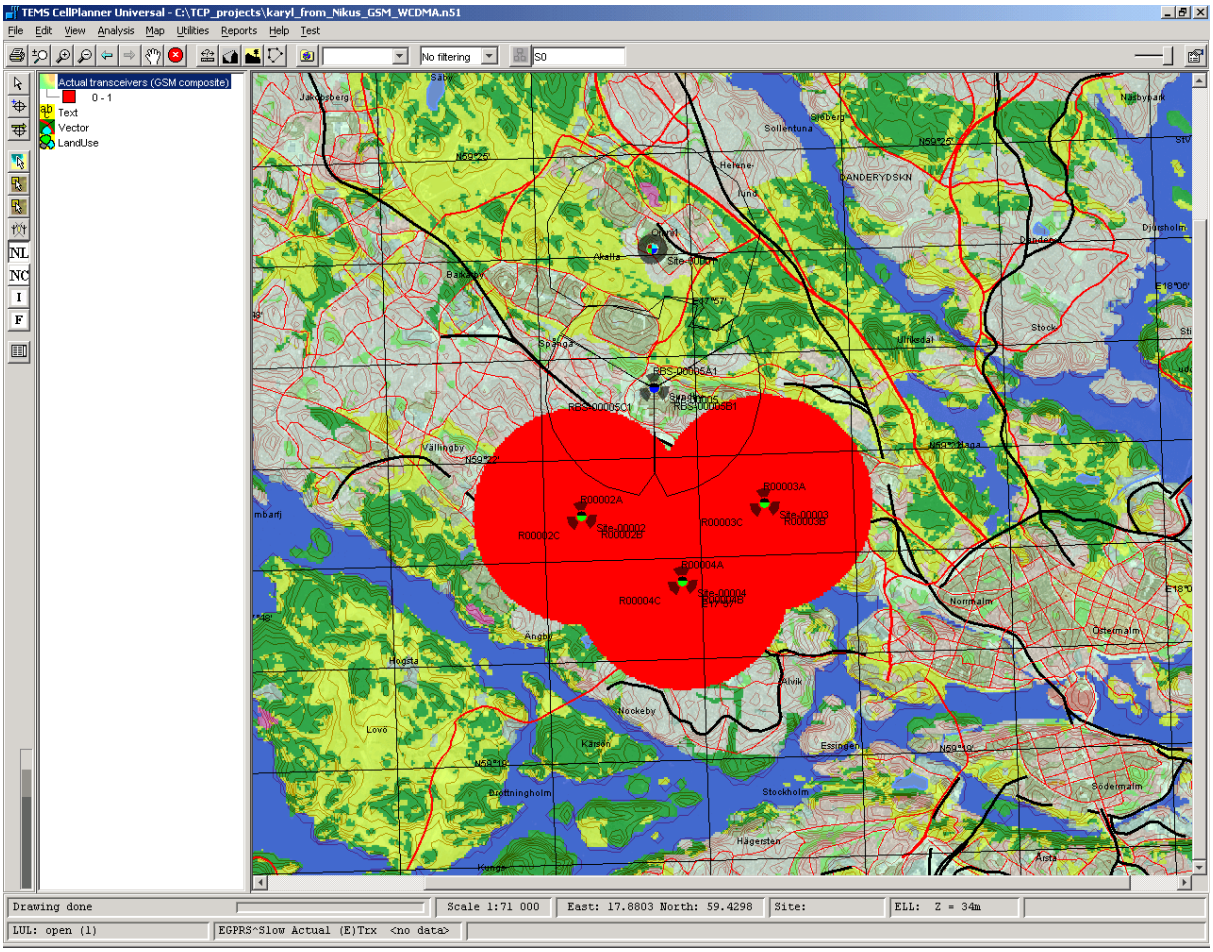
Current ETRX (By Cell)

The figure below shows an example of an actual ETRX plot (by cell), portraying the actual number of EGPRS transceivers assigned to the cell's coverage area:



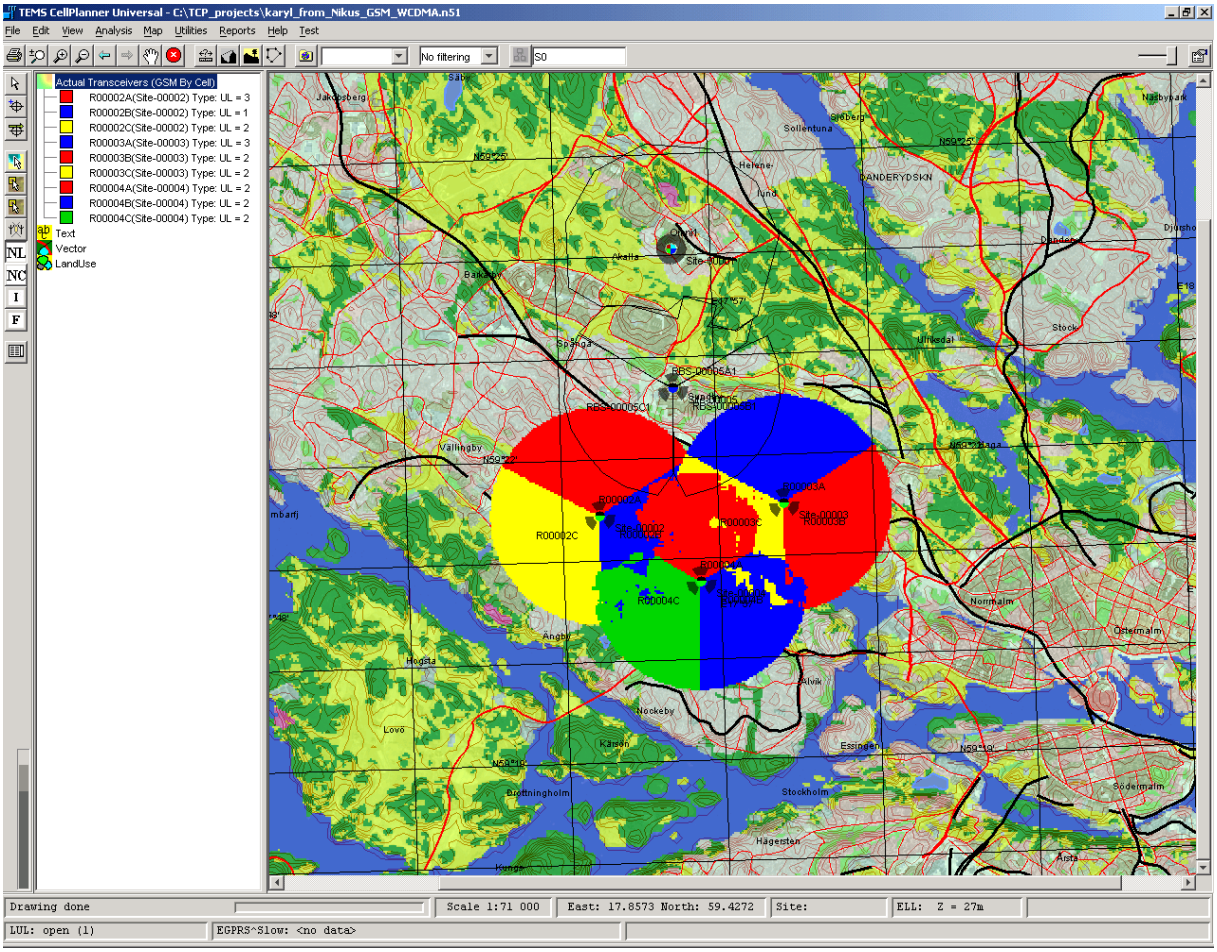
Current ETRX (Composite)

The figure below shows an example of an actual ETRX plot (composite), portraying the actual number of EGPRS transceivers assigned to the composite coverage area:



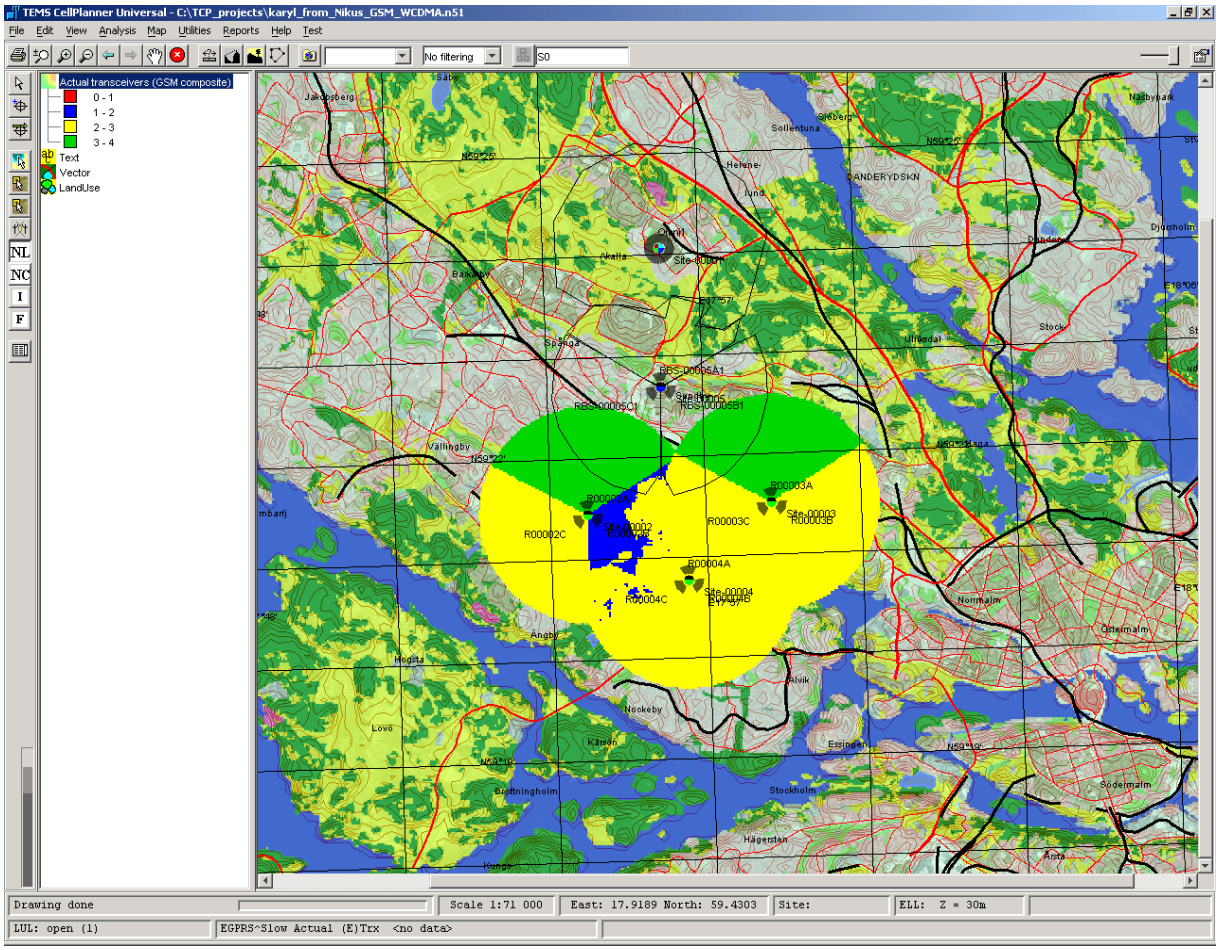
Current TRX (By Cell)

The figure below shows an example of an actual TRX by cell plot, showing the number of TRXs currently assigned per cell:



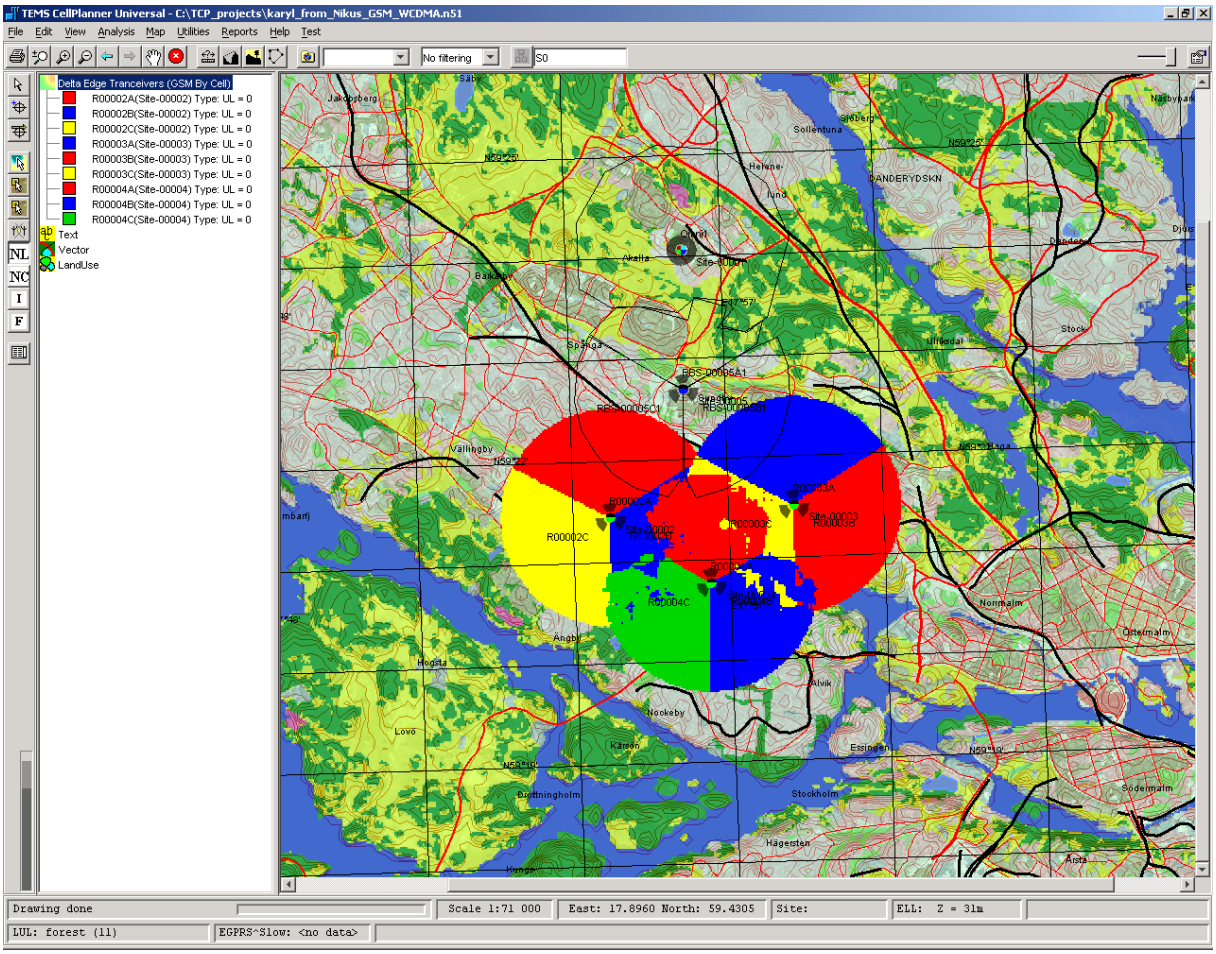
Current TRX (Composite)

The figure below shows an example of an actual TRX composite plot, showing the number of TRXs currently assigned per the cell's coverage area:



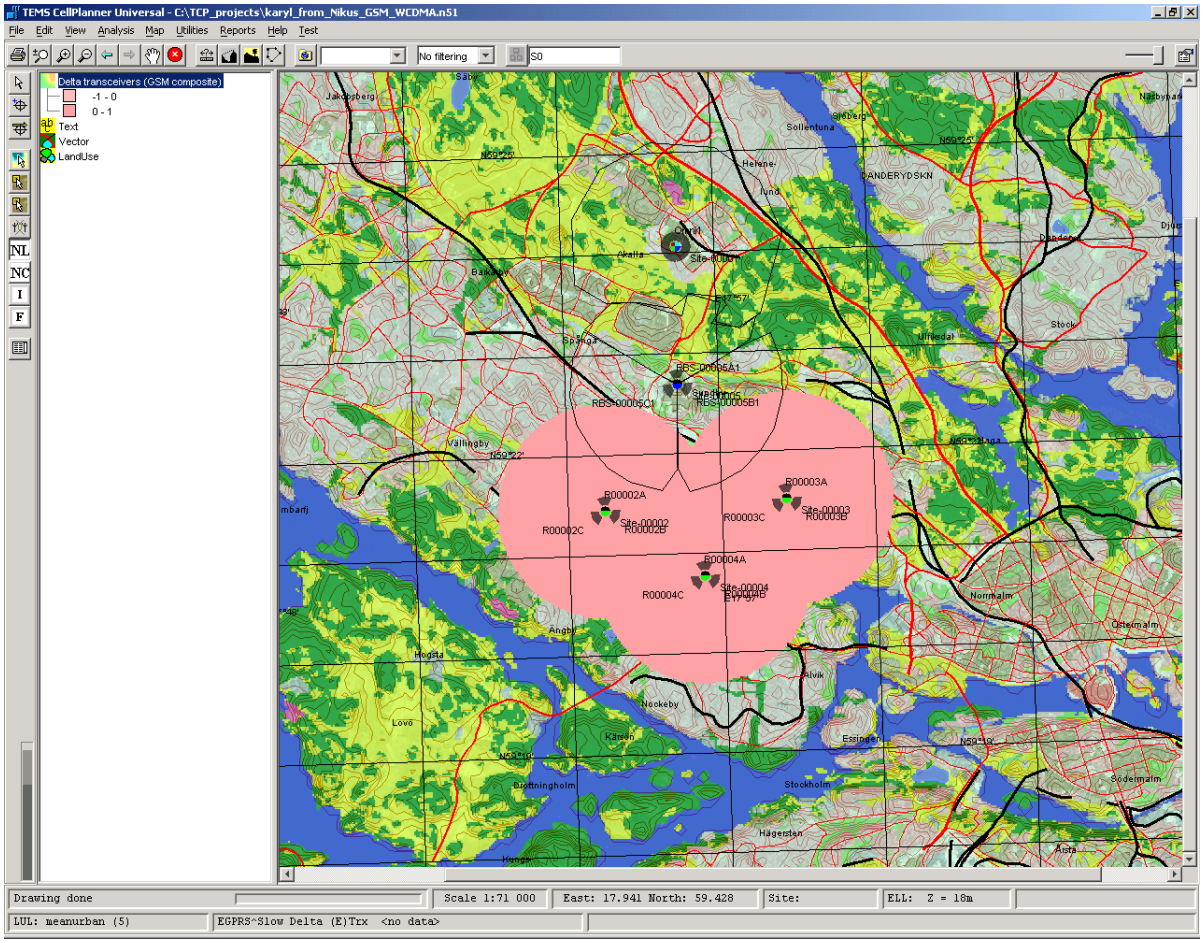
Delta ETRX (By Cell)

The figure below shows an example of a delta ETRX plot (by cell), portraying the difference between the required and assigned EDGE capable TRXs for the cell's coverage area:



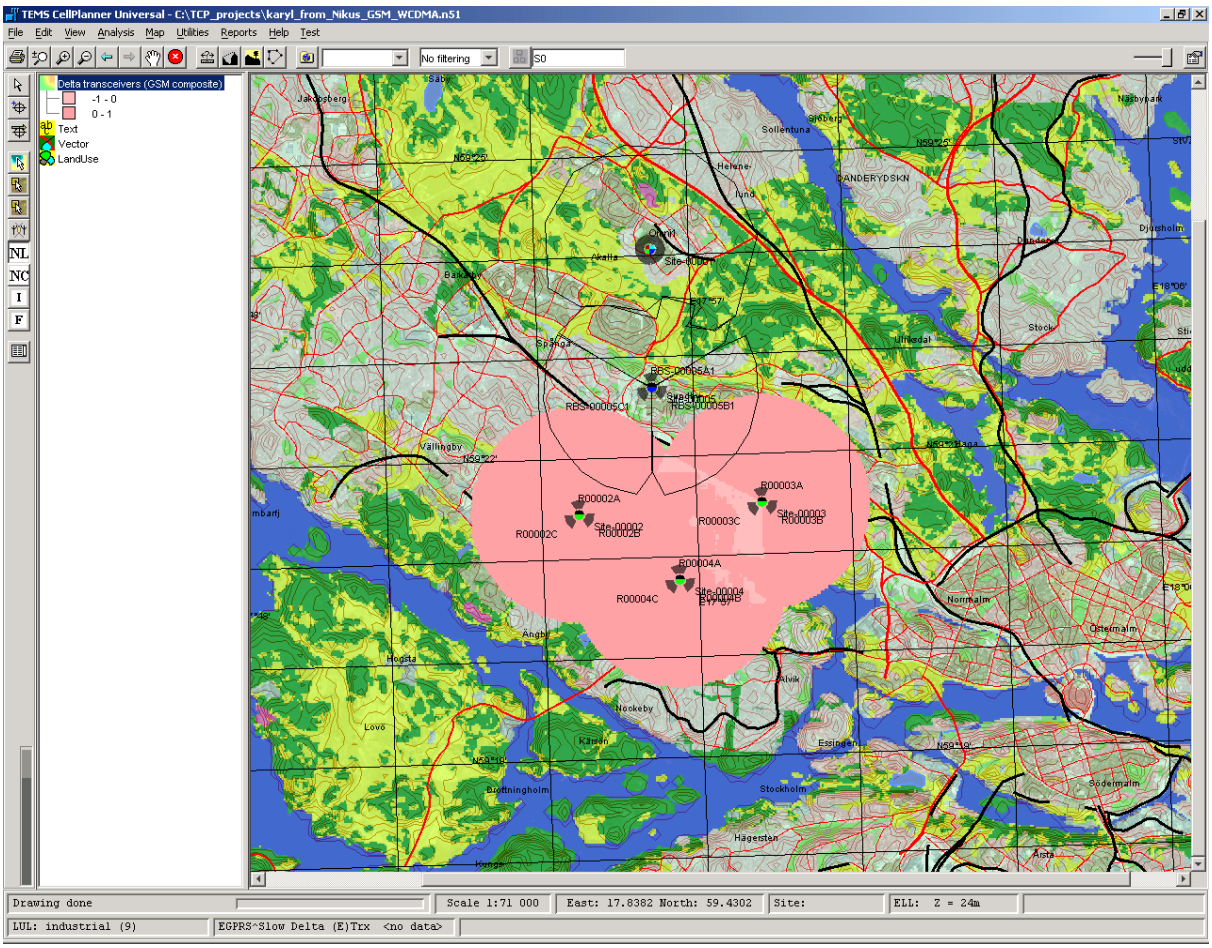
Delta ETRX (Composite)

The figure below shows an example of a delta ETRX plot (composite), portraying the difference between the required and assigned EDGE capable TRXs for the composite coverage area:



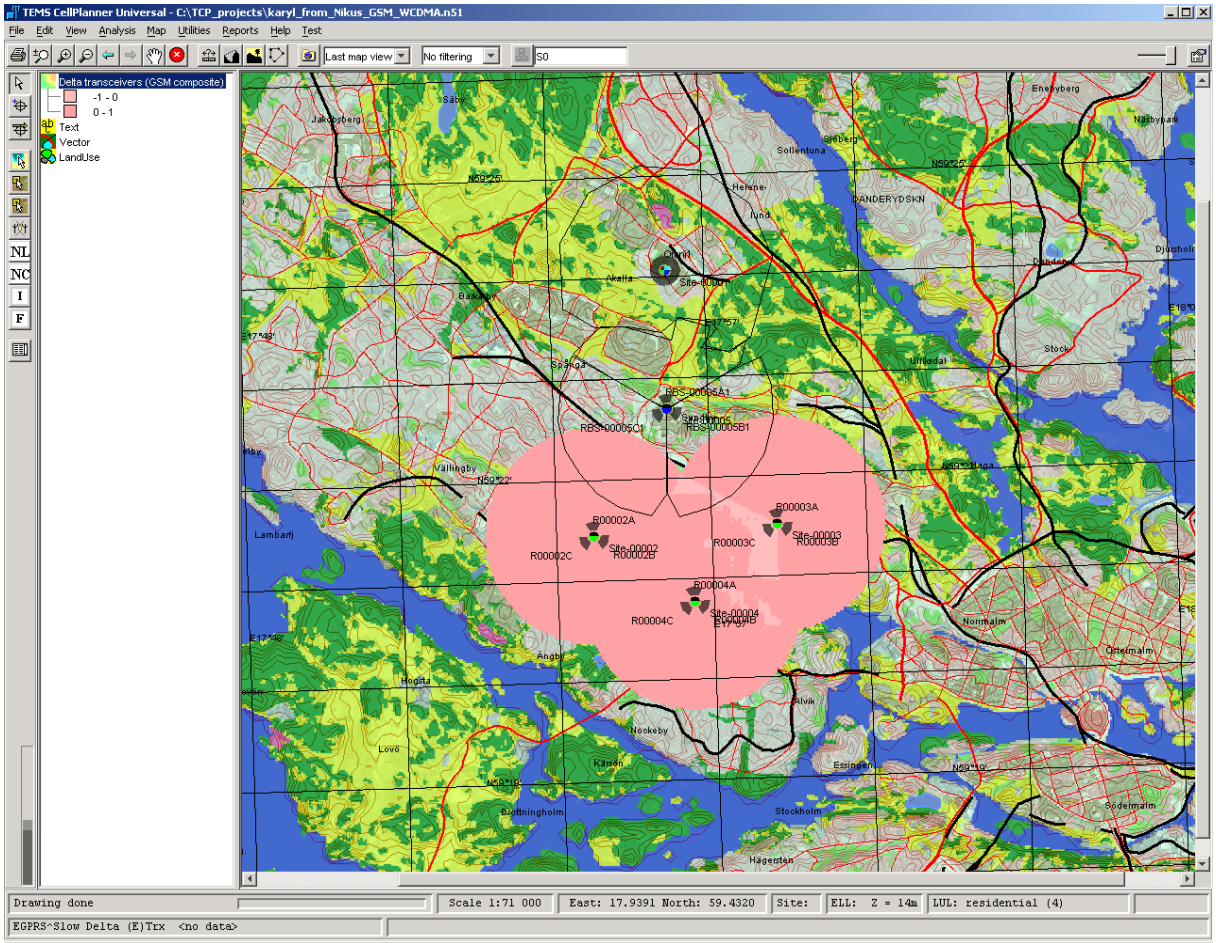
Delta TRX (By Cell)

The figure below shows an example of a delta TRX by cell plot, portraying the difference between the required and assigned TRXs for the cell's coverage area:



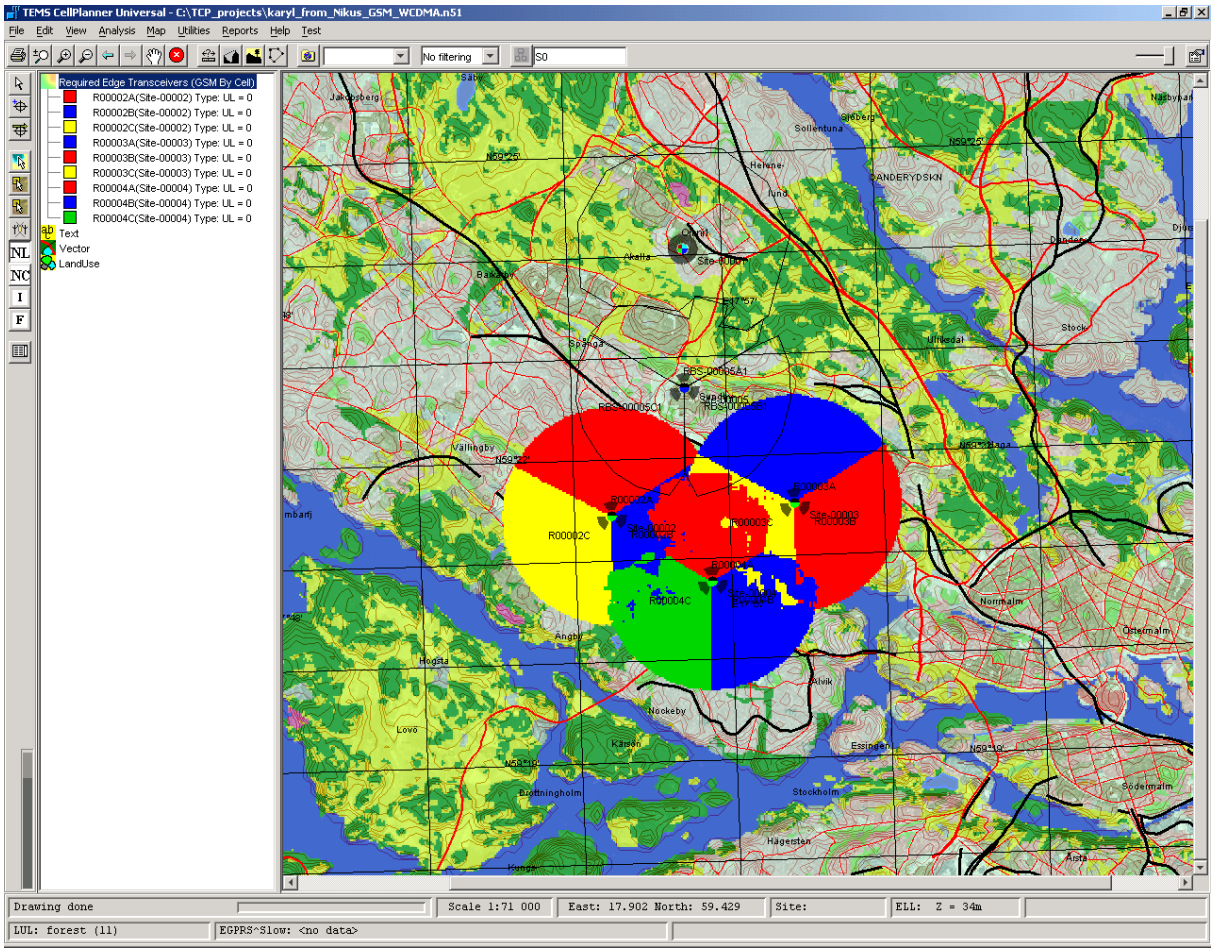
Delta TRX (Composite)

The figure below shows an example of a delta TRX composite plot, showing the difference between the required and assigned TRXs for the composite coverage area:



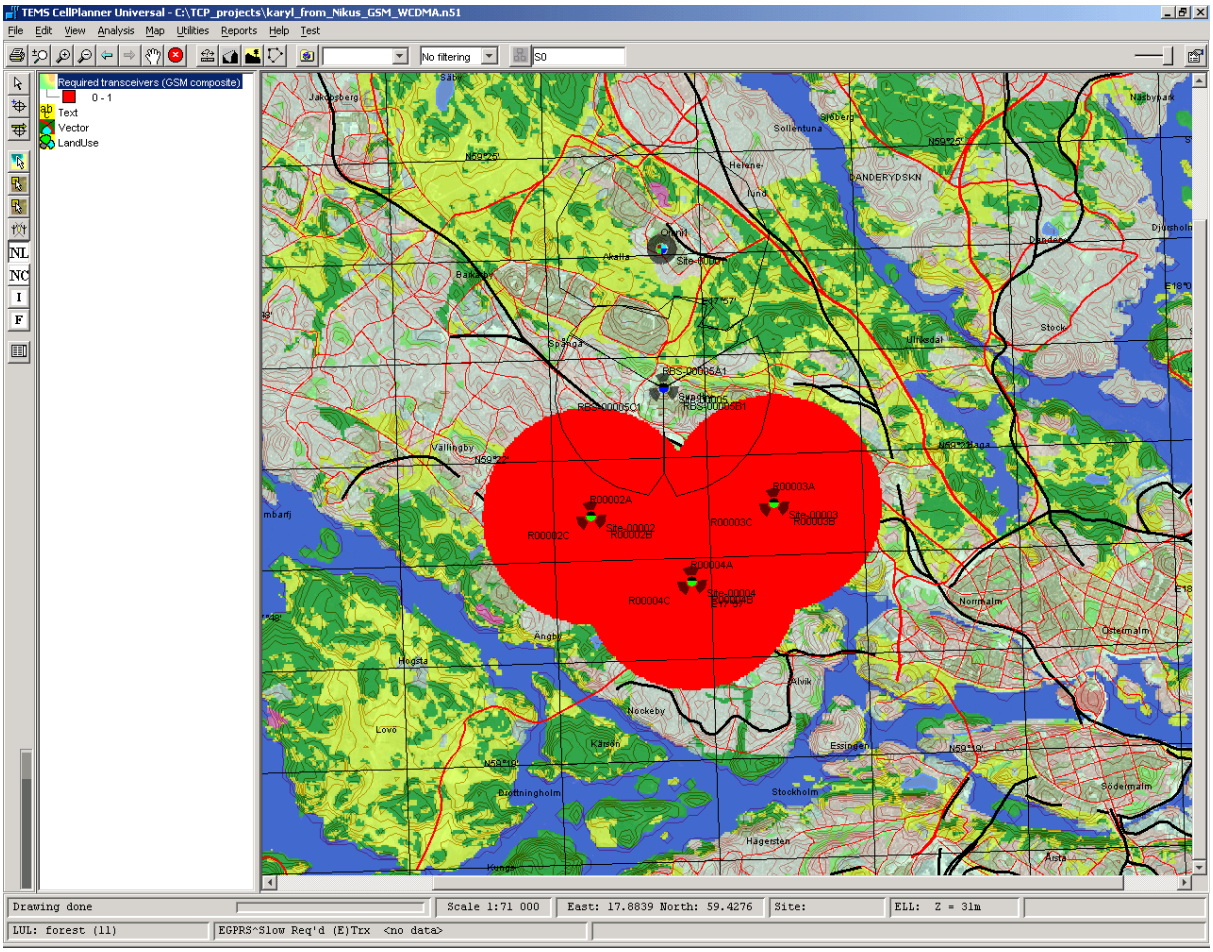
Required ETRX (By Cell)

The figure below shows an example of a required ETRX plot (by cell), portraying the required EDGE capable TRXs for the cell's coverage area:



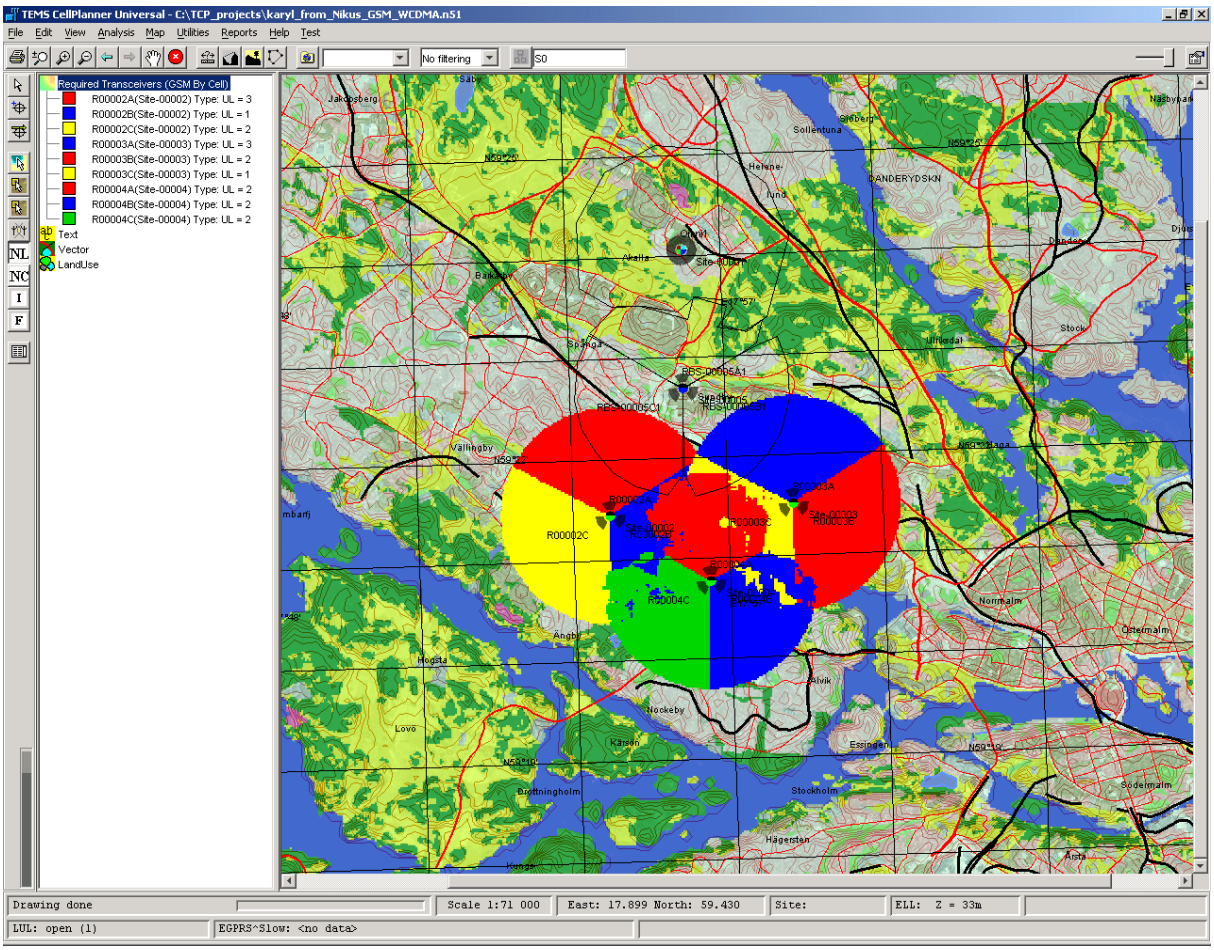
Required ETRX (Composite)

The figure below shows an example of a required ETRX plot (composite), portraying the required EDGE capable TRXs for the composite coverage area:



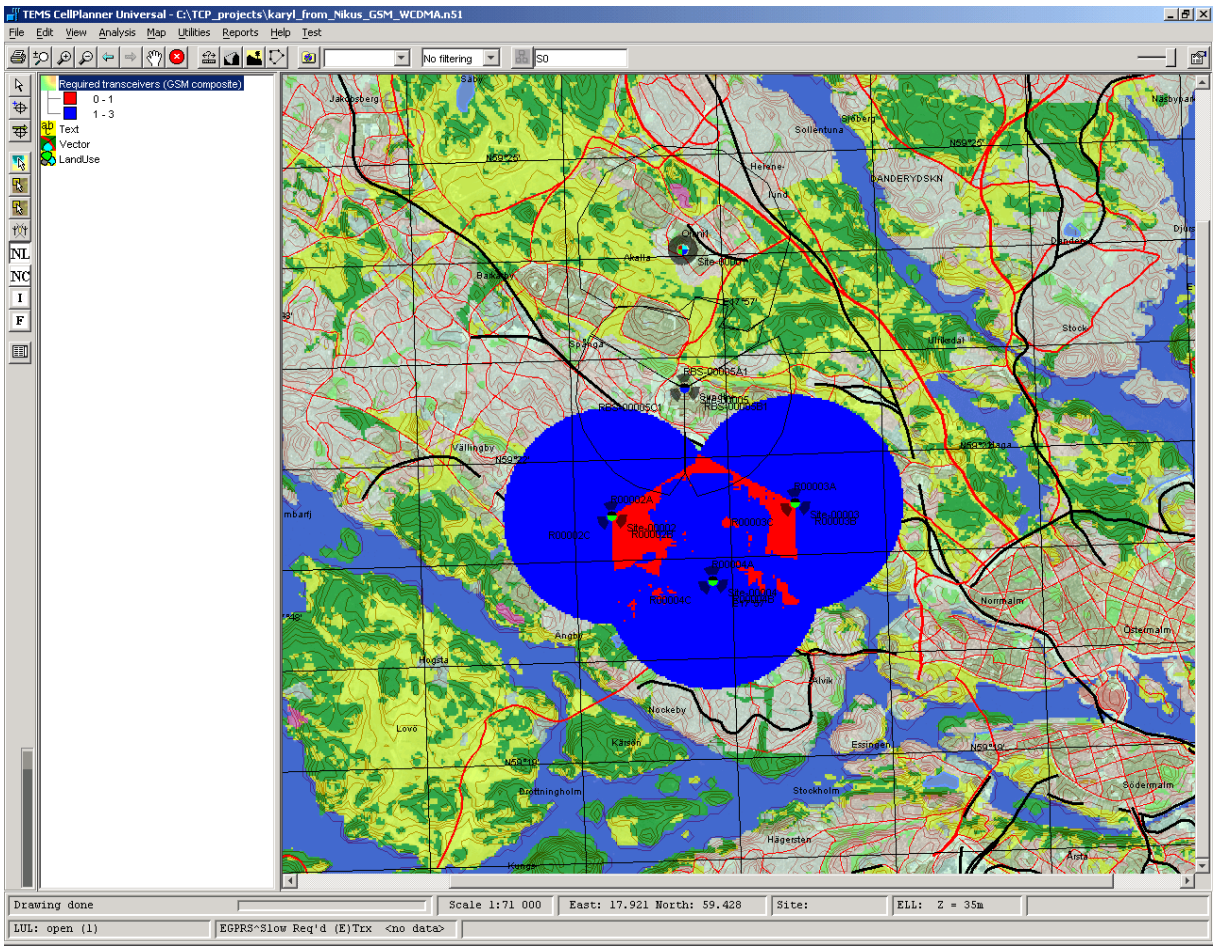
Required TRX (By Cell)

The figure below shows an example of a required TRX by cell plot, portraying the required number of TRXs for the cell's coverage area:



Required TRX (Composite)

The figure below shows an example of a required TRX composite plot, showing TRXs required for the composite coverage area:



Interference Plots

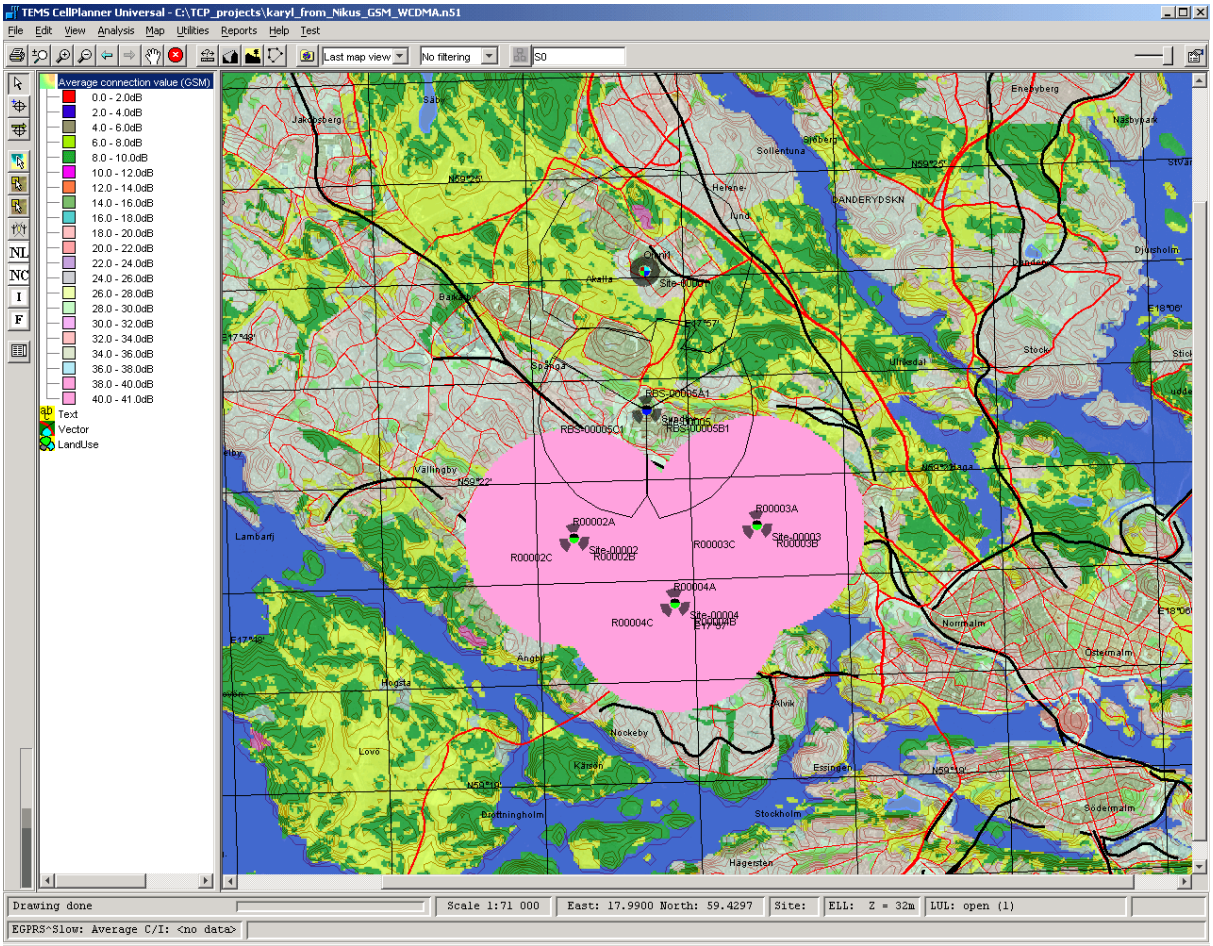
The following interference plots can be generated:

- Average connection
- Interfered BCCH
- Interfered TCH
- Worst connection (by cell or composite)
- Worst interferer (by cell or composite)

Average Connection

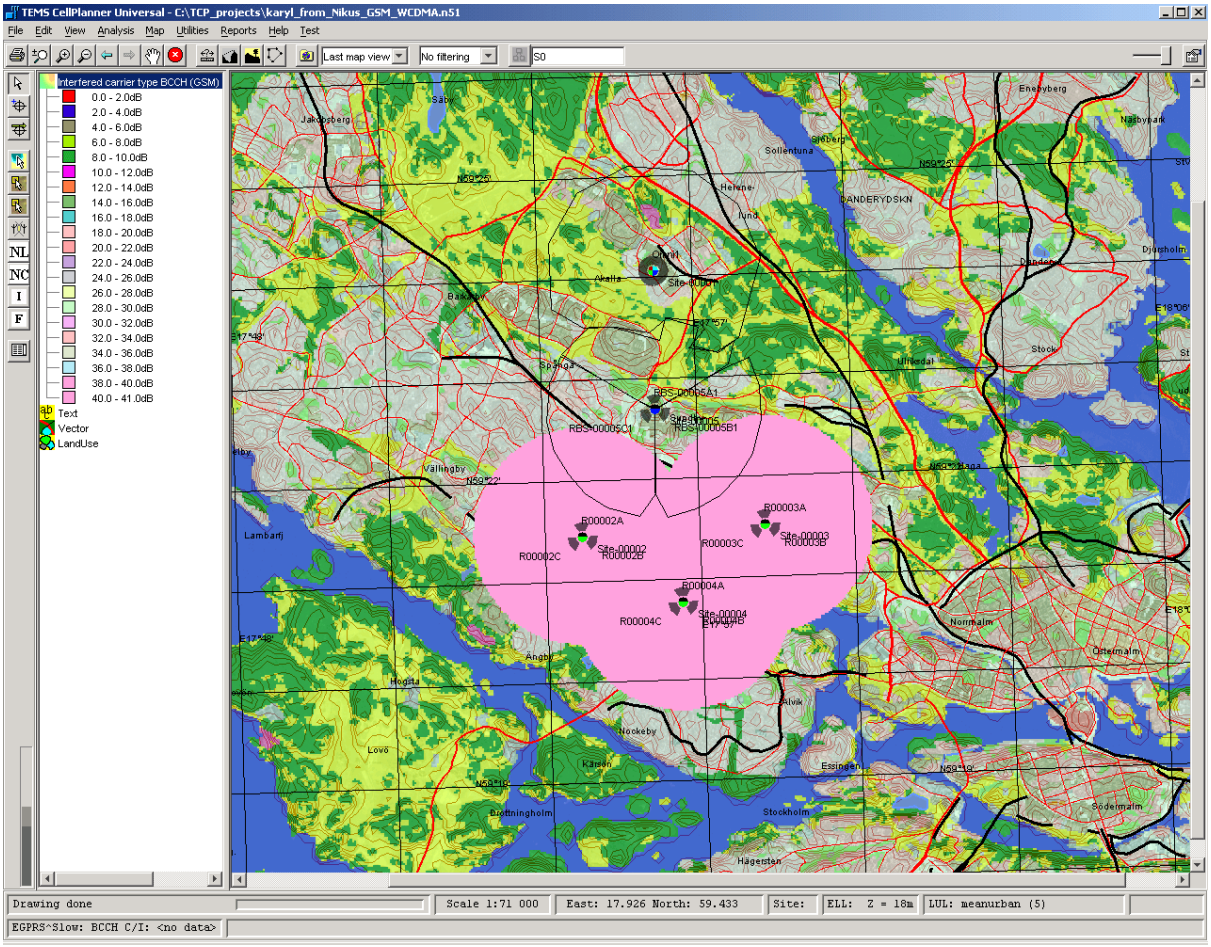
For the Average Connection display, the average C/Ic, C/Ia or C/(Ic+Ia), is calculated over all fixed frequencies and HFSs used for the connection to that bin. The display can be made for BCCH and TCH carriers together.

The figure below shows an example of an average connection plot:



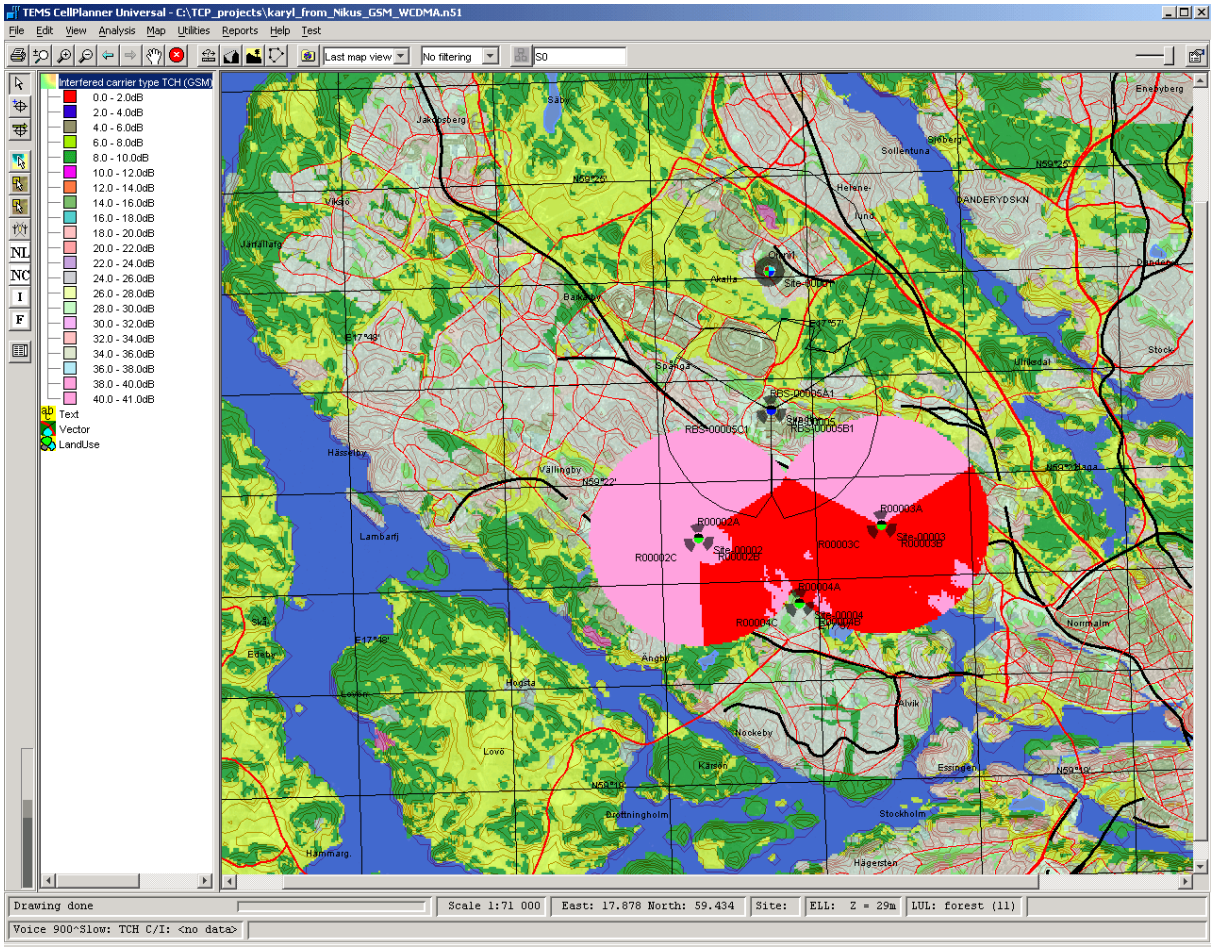
Interfered BCCH

The figure below shows an example of an interfered BCCH plot:



Interfered TCH

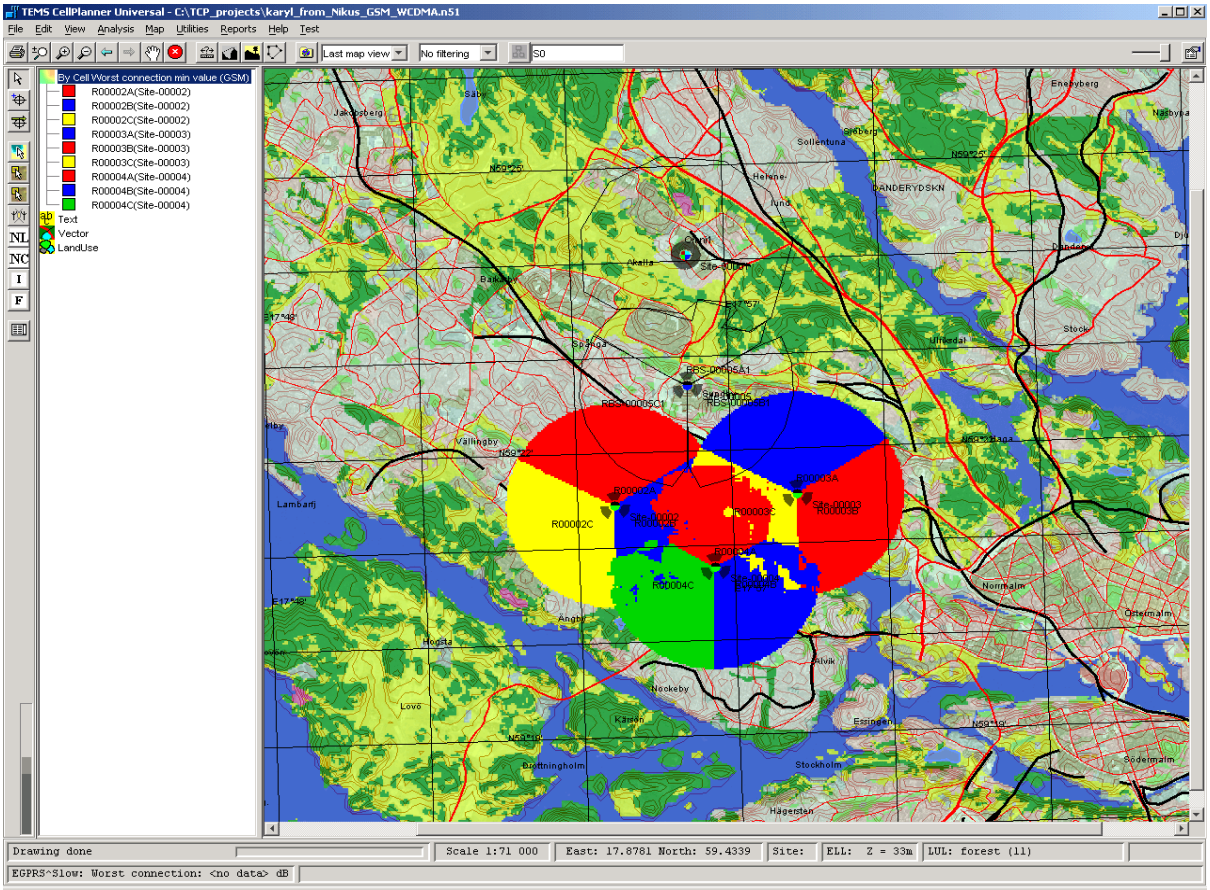
The figure below shows an example of an interfered TCH plot:



Worst Connection (By Cell)

For the Worst Connection by Cell display, the worst C/Ic, C/Ia or C/(Ic+Ia), is calculated for any fixed frequency or HFS used for the connection. You can include BCCH, TCH, or all carriers in the display.

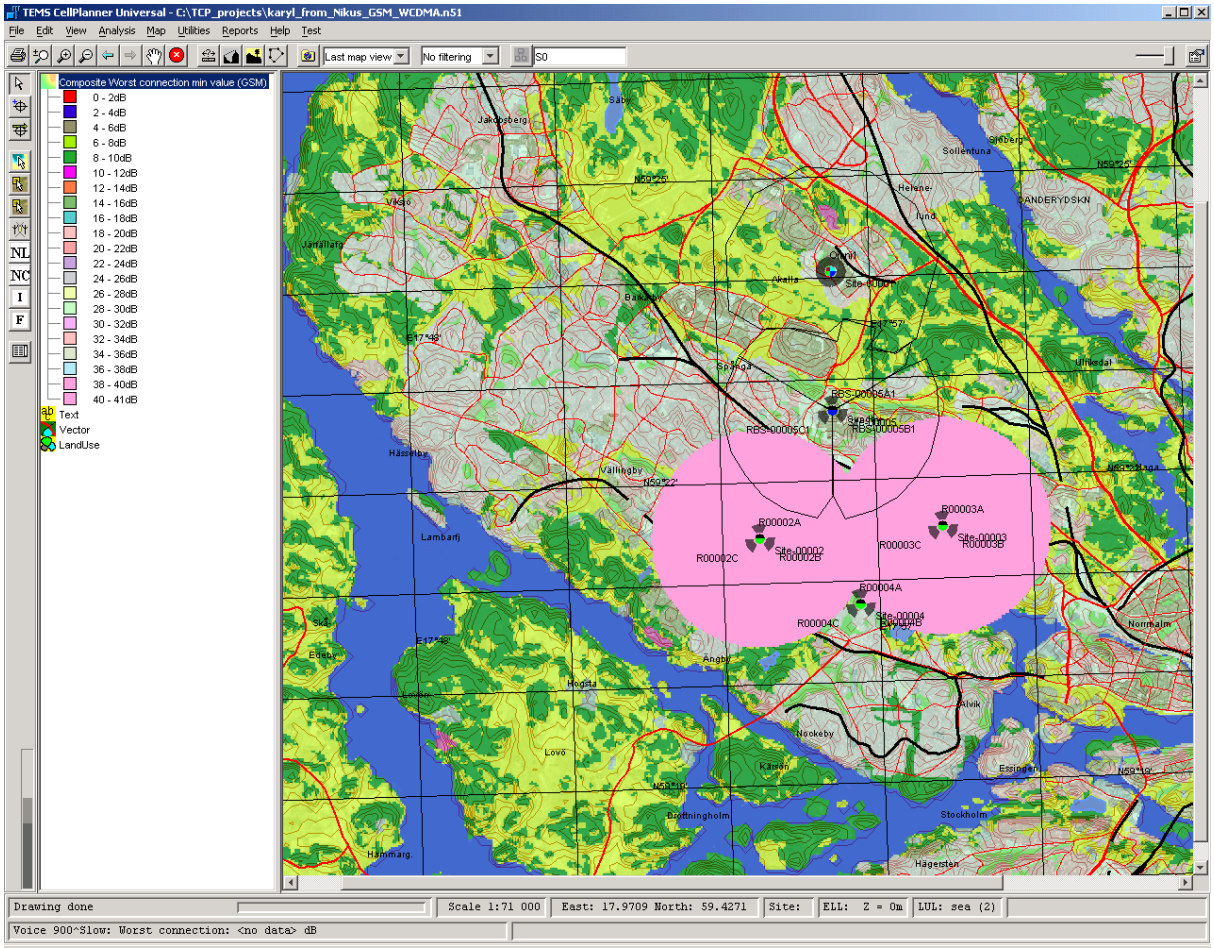
The figure below shows an example of worst connection plot (by cell):



Worst Connection (Composite)

With the Worst Connection Composite you can display “Worst Connection C/(Ic+Ia)”, “Worst Connection C/Ic” or “Worst Connection C/Ia”. You can include BCCH, TCH, or all carriers in the display.

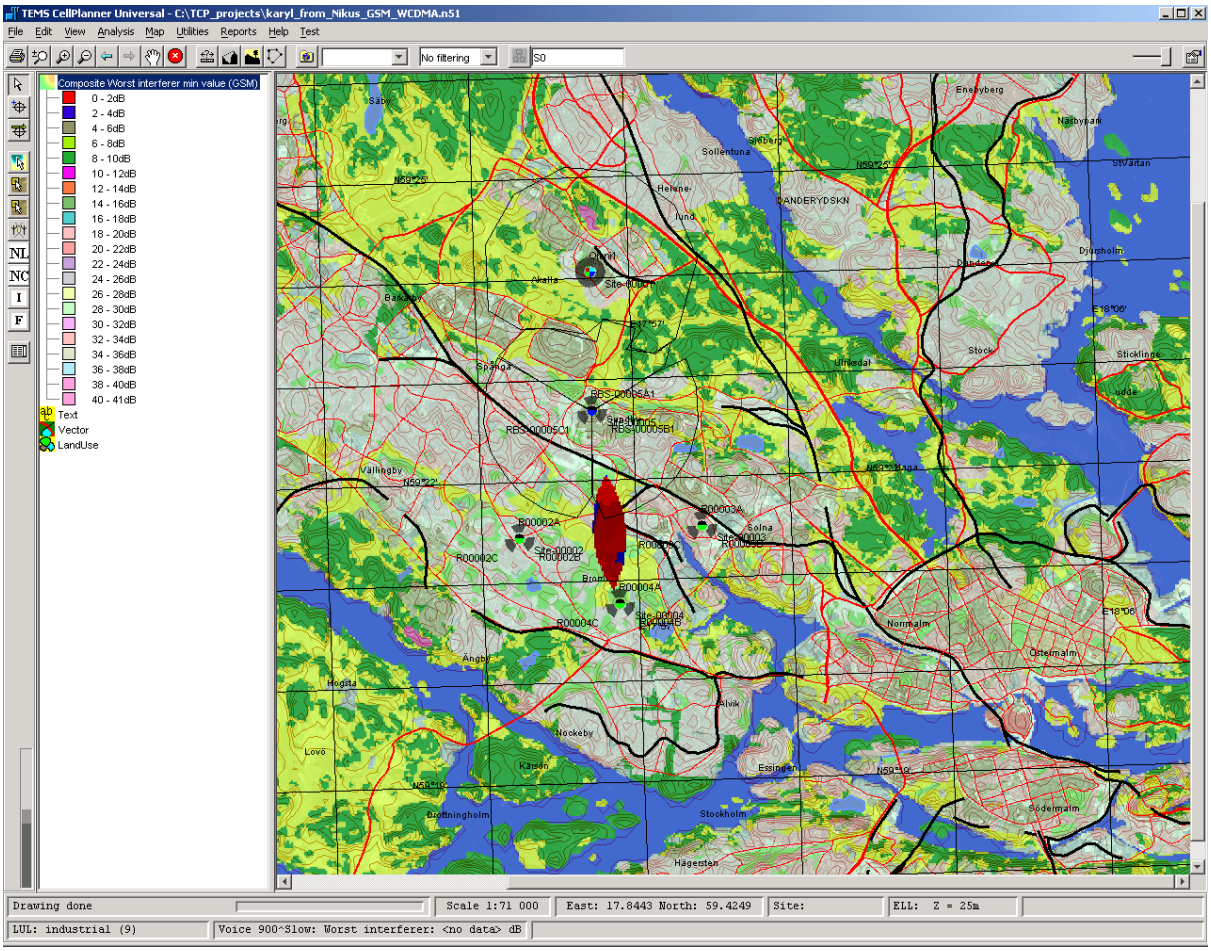
The figure below shows an example of a worst connection plot (composite):



Worst Interferer (By Cell)

For the Worst Interferer by Cell display, the worst C/Ic or C/Ia on any frequency is calculated. You can include BCCH, TCH, or all carriers in the display.

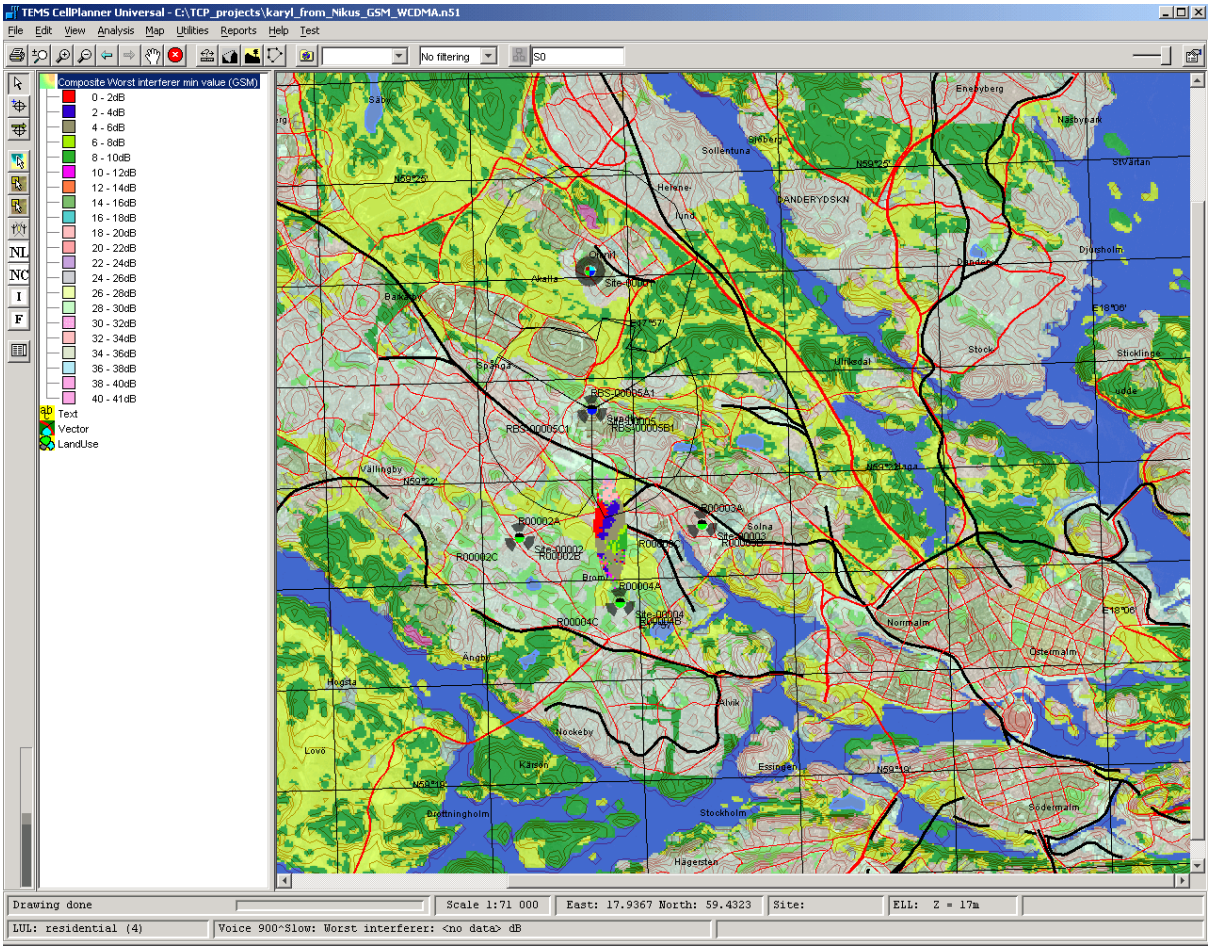
The figure below shows an example of a worst interference plot (by cell):



Worst Interferer (Composite)

For the Worst Interferer Composite display, the C/Ic, or C/Ia is displayed. You can include BCCH, TCH, or all carriers in the display.

The figure below shows an example of a worst interferer plot (composite):



Cell Attribute Display

See *Set the Custom Attribute Display* in the *TEMS CellPlanner Common Features User's Guide*.

17
GSM Reports

This chapter describes how to generate analysis reports from a GSM network plan.

Topic **Page**

About GSM Reports 17-2
GSM Coverage Report, Covered Area 17-2
GSM Coverage Report, Covered Individuals 17-3
Interference Report 17-4
Automatic Frequency Planning (AFP) Report 17-5

About GSM Reports

A *report* is a textual description of the graphical information in an analysis area. Reports are valuable complements to plots, as they give a more complete overview of analysis results, and they can include more information than plots.

You can generate reports in MS Excel or text format.

The following reports are relevant for a GSM network plan:

- GSM Coverage Report, Covered Area
- GSM Coverage Report, Covered Individuals
- Interference Report
- Automatic Frequency Planning (AFP) Report
  Includes channel numbers not displayed in plots
- Site installation report, see the *TEMS CellPlanner Common Features User's Guide*

Chapter *Working with Reports* in the *TEMS CellPlanner Common Features User's Guide* describes how to customize reports.

GSM Coverage Report, Covered Area

This report tells how many square kilometers are covered according to definition:

A bin is covered if a UE in the bin receives a signal strength > -95 dB.

For a given area the following is reported:

- area (km^2) covered in the network plan
- area (km^2) covered by a specific cell
- area (km^2) covered by a specific cell in a coverage area where the cell is also the best server
- percentage (%) of area covered by a specific cell in a coverage area where the cell is also the best server, compared to the total area covered by the cell

The results are organized:

- per cell (cells sheet)
- per land use category, summed over all cells (summary sheet)

Prerequisites

- The land use categories to report as covered must be included in a landuse map layer in the Project settings, see *Add Map Layers to Projects* in the *TEMS CellPlanner Common Features User's Guide*.

- Pathloss calculation results are available for the area to report.
- Best Server Analysis results are available for the area to report.

Procedure

1. Select **Reports↗GSM↗Coverage. The GSM best server report window appears.**
2. Select **Coverage for land use map**.
3. Select traffic case for which to report the **Best server** coverage.
4. Enter the other parameters and click **Generate.** The report is created.

GSM Coverage Report, Covered Individuals

This report tells how many individuals are covered, based on demographic data specifying the population density of various demographic categories in certain areas. *A bin is covered if a UE in the bin receives a signal strength > -95 dB.*

For a given area the following is reported:

- number of individuals covered in the network plan
- total number of individuals covered by a specific cell
- number of individuals covered by a specific cell in a coverage area where the cell is also the best server
- percentage (%) of individuals covered by a specific cell in a coverage area where the cell is also the best server, compared to total number of individuals covered by the cell

The results are organized:

- per demographic category and cell (category sheet)
- per demographic category, summed over all cells (summary sheet)
- per cell, summed over all demographic categories (summary sheet)

Prerequisites

- The demographic data to report are included as a map layer in the Project settings, see *Add Map Layers to Projects* in the *TEMS CellPlanner Common Features User's Guide*.
- Pathloss calculation results are available for the area to report.
- Best Server Analysis results are available for the area to report.

Procedure

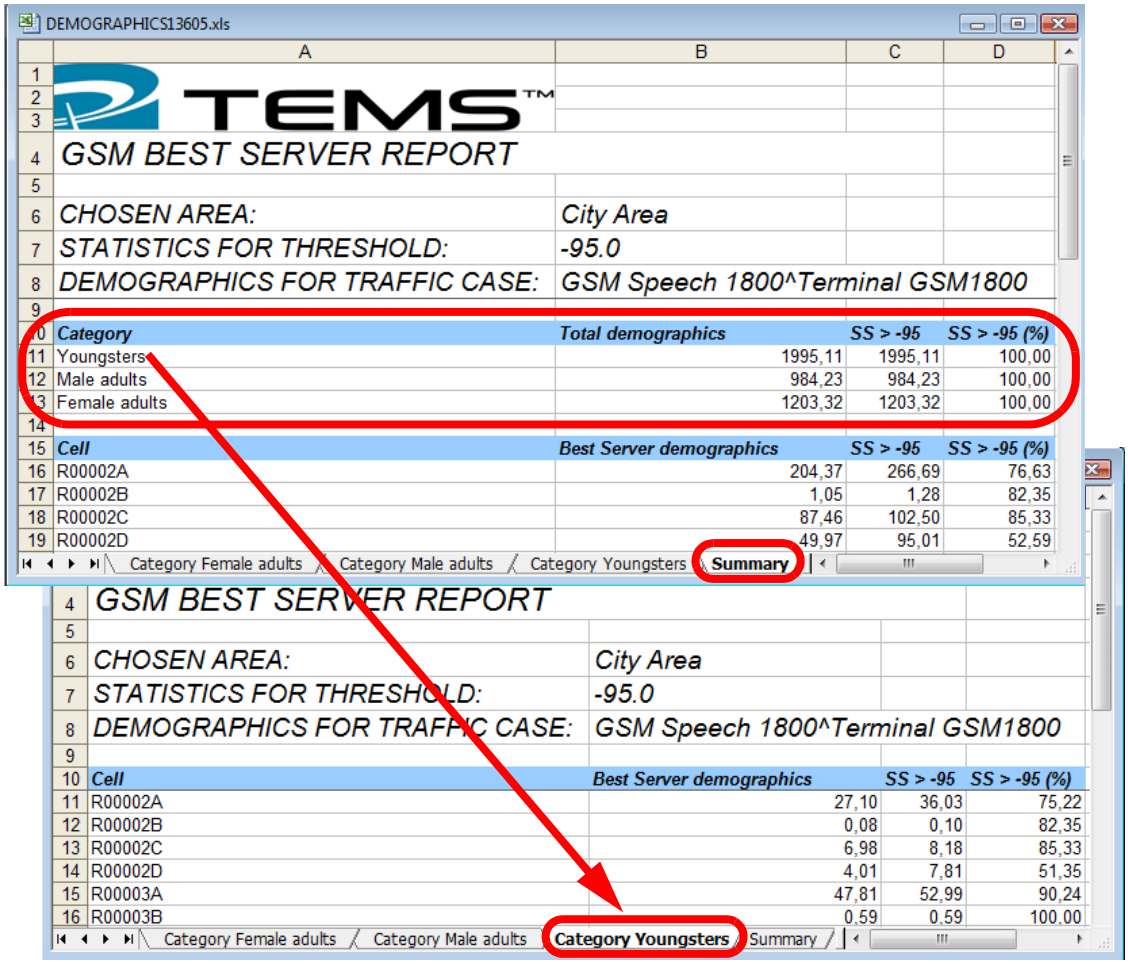
1. Select **Reports↗GSM↗Coverage. The GSM best server report window appears.**

2. Select **Demographics for demographic map**.
3. Select traffic case for which to report the **Best server** demographics.
4. Enter the other parameters and click **Generate.** The report is created, see Example: GSM Best Server Demographics Excel Report.

Example: GSM Best Server Demographics Excel Report

The examples below show a demographics report in Excel format, with one summary sheet and one sheet per demographic category.

SS in the column headings stands for Signal Strength.



DEMOGRAPHICS13605.xls

	A	B	C	D
4	GSM BEST SERVER REPORT			
6	CHOSEN AREA:	City Area		
7	STATISTICS FOR THRESHOLD:	-95.0		
8	DEMOGRAPHICS FOR TRAFFIC CASE:	GSM Speech 1800^Terminal GSM1800		
10	Category	Total demographics	SS > -95	SS > -95 (%)
11	Youngsters	1995,11	1995,11	100,00
12	Male adults	984,23	984,23	100,00
13	Female adults	1203,32	1203,32	100,00
15	Cell	Best Server demographics	SS > -95	SS > -95 (%)
16	R00002A	204,37	266,69	76,63
17	R00002B	1,05	1,28	82,35
18	R00002C	87,46	102,50	85,33
19	R00002D	49,97	95,01	52,59

Category Female adults | Category Male adults | Category Youngsters | Summary

4	GSM BEST SERVER REPORT			
6	CHOSEN AREA:	City Area		
7	STATISTICS FOR THRESHOLD:	-95.0		
8	DEMOGRAPHICS FOR TRAFFIC CASE:	GSM Speech 1800^Terminal GSM1800		
10	Cell	Best Server demographics	SS > -95	SS > -95 (%)
11	R00002A	27,10	36,03	75,22
12	R00002B	0,08	0,10	82,35
13	R00002C	6,98	8,18	85,33
14	R00002D	4,01	7,81	51,35
15	R00003A	47,81	52,99	90,24
16	R00003B	0,59	0,59	100,00

Category Female adults | Category Male adults | Category Youngsters | Summary

Interference Report

For a given area and C/I threshold, and a selected interference plot (worst interferer or worst connection) the follow is reported:

- total area
- poor quality area (C/I < threshold)
- poor quality area in %, calculated as (poor quality area / total area)
- good quality area (C/I >= threshold)
- good quality area in %, calculated as (good quality area / total area)

The total interference is reported, not per land use code or per cell.

Automatic Frequency Planning (AFP) Report

For each TRX the following is reported:

- frequency or frequency group
- HSN list, if applicable
- MAIO list, if applicable

Additionally, for each cell the following is reported:

- NCC
- BCC, identical to BSIC
- TSC, often identical to BCC

18
Advanced GSM Features

This chapter describes the advanced GSM features of TEMS CellPlanner.

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Frequency Planning in TEMS CellPlanner 18-2
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Automatic Frequency Planning (AFP) 18-7
AFP for Fixed Frequency or Baseband Hopping 18-9
Run AFP for Fixed Frequency or Baseband Hopping 18-9
Define Separation Specification 18-13
Mixed Planning for Fixed BCCH & Synth Hopping TCHs 18-17
Using Imported Interference Tables (ICDM) in AFP 18-8
AFP for Synth Hopping 18-19
Run AFP for Synth Hopping 18-19
BSIC Optimization 18-23
Optimize BSIC 18-24
Analyze the BSIC Plan. 18-24
HSN Optimization 18-26
Optimize HSN. 18-26
Analyze HSN 18-27
MAIO Optimization 18-28
Optimize MAIO 18-28

Frequency Planning in TEMS CellPlanner

TEMS CellPlanner provides a number of functions to plan frequencies for GSM. Which function to use depends on the type of frequency hopping, and if the impact from interference on the frequency plan shall be considered or ignored.

The table below summarizes which functions to use for typical scenarios:

	No interference considered	**Interference considered**
Fixed frequency (no hopping) Baseband hopping	Manually Optimized Frequency Planning	AFP for Fixed Frequency or Baseband Hopping
Synthesizer hopping	Assign frequencies, by hand, per channel group, see Define Channel Group for GSM Cells	AFP for Synth Hopping

In some cases none of those functions can be used, and instead you must perform a pure manual planning where you assign frequencies to TRXs in the channel group editor.

For an overview of AFP, see Automatic Frequency Planning (AFP).

For in-depth information on terminology and principles used in frequency planning, refer to the *TEMS CellPlanner GSM Technical Reference Manual*.

Manually Optimized Frequency Planning

Frequency groups must be planned manually with this function when a specific frequency reuse pattern is desired.

The manual frequency optimization function allows you to quickly assign frequencies to a cluster of cells, a channel group, or to individual TRXs (transceivers). Even though the planning is called "manual" it is semi-automatic, as many frequencies can be assigned at the same time, considering a reuse pattern. You can try various assignments until you are satisfied with the results. First when you apply the results, you update the project with the new frequency plan.

You can plan for single or multiple frequency bands, and the BCCH and TCH carrier layers may overlap.

Read about Frequency Planning in TEMS CellPlanner to see for which cases you should use this function, and when other functions are more suitable.

Prerequisites

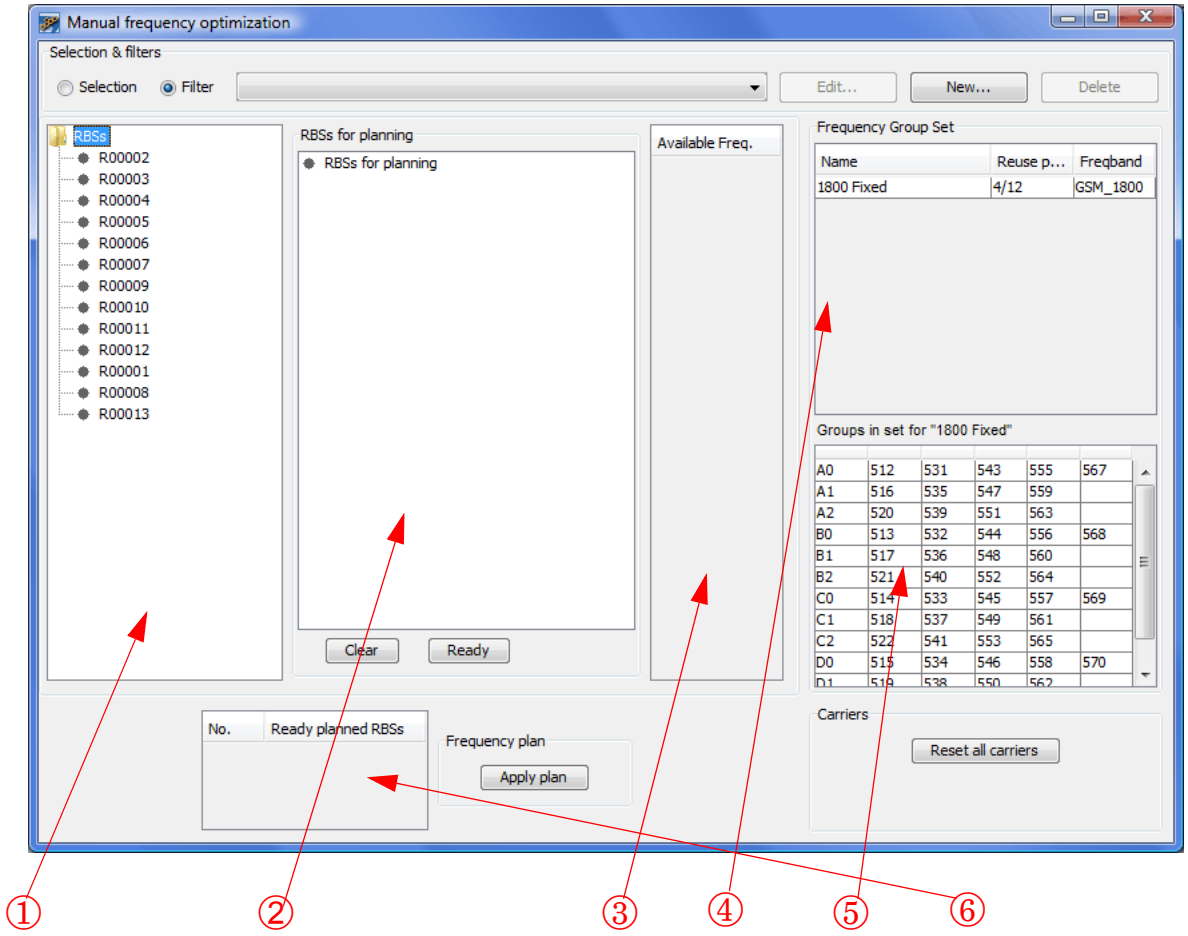
- The frequency group sets to use for planning have the required reuse factor, and are configured for fixed frequency or baseband hopping (option **Baseband/ No hopping**). See Define Frequency Group Sets on page 6-10.
- The cells to plan have channel groups with TRXs configured for either fixed frequency (option **Fixed**) or baseband hopping (option **Baseband hop**), see Define Channel Group for GSM Cells on page 9-26.

Procedure

Do as follows to plan the frequencies manually. The numbers (① etc.) are described in Fields on Window "Manual frequency optimization" on page 18-4.

1. Select **Analysis↗GSM↗Manually optimize frequency plan**. The **Manual frequency optimization window** appears
2. Select a reuse pattern from the frequency group set area ④.
3. Drag and drop RBSs into the planning area (from ① to ②).
   The number of required RBSs depend on the reuse pattern.
4. How to assign frequencies depends on whether you update multiple cells, a single channel group, or a single TRX:
   a. A cluster of cells can be assigned frequencies from a frequency group set: Drag the desired frequency group set from ④) and drop it anywhere in ②.
   b. A single channel group (for example UL_0) of a cell can be assigned frequencies from a frequency group: Drag the desired frequency group from ⑤ and drop it on the channel group in ②.
   c. A single TRX (▬) can be assigned a specific frequency: Select the TRX in ②. Area ③ shows all frequencies possible to assign to the TRX. Left-click the desired frequency.

Manual Frequency Optimization Window



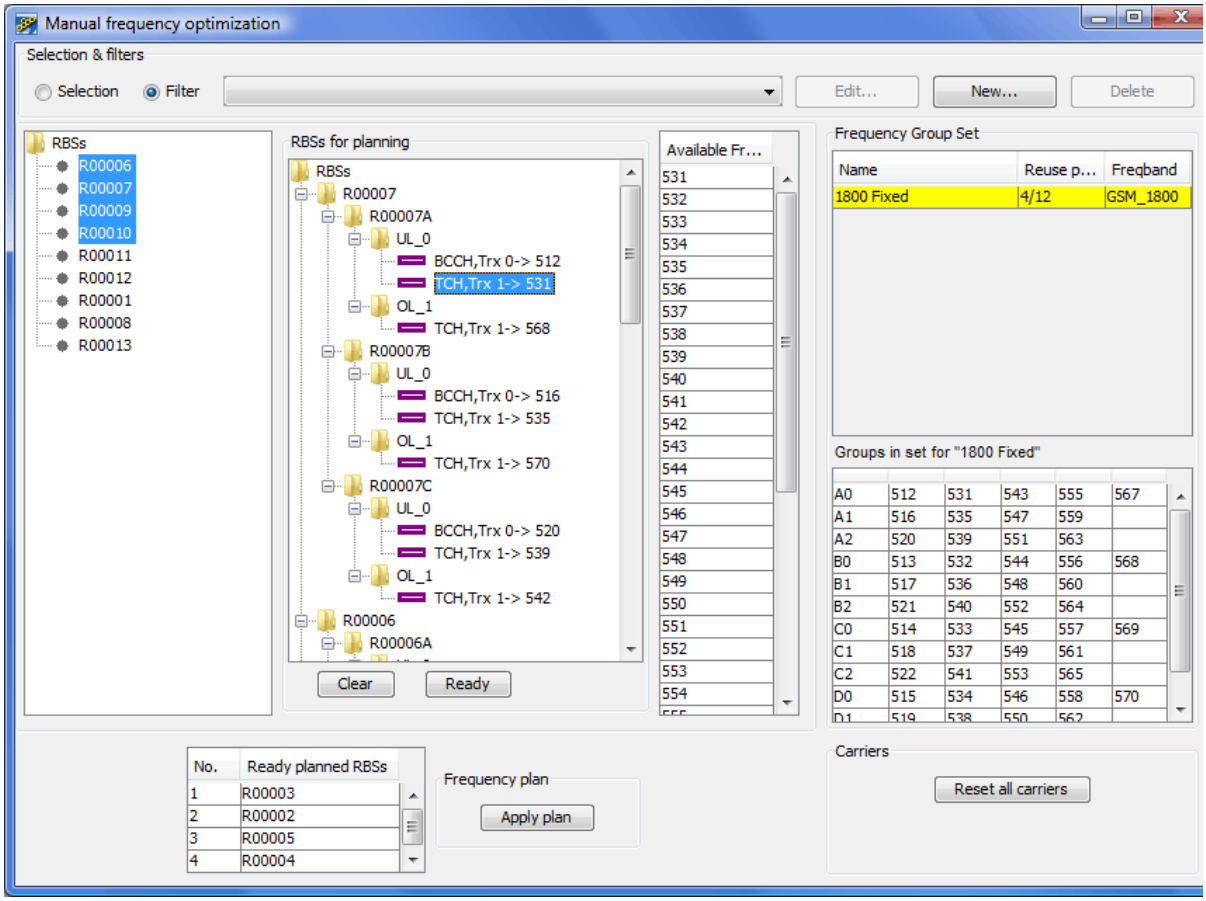
Fields on Window "Manual frequency optimization"

①	(list of RBSs)	All GSM RBSs available for manual planning.
②	RBSs for planning	RBSs selected for planning, by drag and drop from ①. Choose the number of RBSs required by the reuse pattern in ④. With reuse pattern 1/3, it is sufficient to move one RBS from ① to ②. With reuse pattern 3/9, you must move 3 RBSs, and so forth.
③	Available Freq	Frequencies possible to assign to a selected TRX in ②.
④	Frequency Group Set	Frequency Group Sets available for planning. One set per row is displayed in this area, with information about each group set (Name, Reuse pattern, Frequency band). Left-click on a set in ④ to display its groups in area ⑤.
⑤	Groups in set for <name of frequency group set>	Frequency groups of a frequency group set selected in area ④.

⑥	**Ready planned RBSs**	Sequence number (**No.**) and name of RBSs moved here from the planning area ②
Buttons:		
	Clear	Removes sites from ②, as an undo operation.
	Ready	Moves RBSs from ② to ⑥, awaiting to be applied to the project.
	Apply plan	Applies the ready RBSs in ⑥ to the project.
	Reset all carriers	Resets all frequency assignments and makes frequencies available for new planning.

Example of Manually Optimized Frequency Plan

The GSM 1800 frequency plan below is based on a 4/12 reuse pattern for fixed frequencies. Four RBSs are already planned. Four other RBSs have recently been assigned frequencies from the frequency group set, but they are not yet moved to the list of planned RBSs at the bottom of the window. The OL sub-cell of cell R00007A has one TCH TRX (TRX 1), and it is assigned frequency 568.



Automatic Frequency Planning (AFP)

TEMS CellPlanner provides two functions for Automatic Frequency Planning (AFP). The functions are similar but used for different purposes:

- AFP for Fixed Frequency or Baseband Hopping
- AFP for Synth Hopping

Both AFP functions require that you have access to an AFP license.

AFP assigns frequencies to BCCH and TCH layers in new or existing GSM frequency plans, taking the interference impact into account. The resulting plan fulfills as many separation requirements as possible, with as low interference cost as possible.

You can configure AFP to try various assignments, and apply the results into the project when you are satisfied with the result.

Read about Frequency Planning in TEMS CellPlanner to see for which cases you should use any of the AFP functions, and when other functions are more suitable.

Limitations on AFP

The following limitations are valid both for AFP for Fixed Frequency or Baseband Hopping and AFP for Synth Hopping:

- One frequency band at a time can be planned. It is possible to plan frequencies for dual-band networks and dual-band cells, but AFP must be run once for each frequency band.
- AFP does not support MRP planning
- Frequency groups sets are ignored

Prerequisites for AFP

The following prerequisites are valid both for AFP for Fixed Frequency or Baseband Hopping and AFP for Synth Hopping:

- Define GSM Frequency Bands for BCCH and TCH
- Define GSM RBSs and Cells with GSM Carrier Mappings
- Optional: Define Filters to limit the number of cells to plan and border cells to consider while optimizing
- Calculate Pathloss
- Run Best Server Analysis to calculate coverage
- Read Using Imported Interference Tables (ICDM) in AFP, then Calculate and/or Import Interference Tables
- Calculate GSM Traffic Performance, needed only if traffic shall be considered in the AFP (traffic weights > 0)

Using Imported Interference Tables (ICDM) in AFP

This section outlines what is most important when you want to use imported interference values from an ICDM file in your frequency planning with AFP.

- **The ICDM file might need to be edited**. What to edit depends on the version of the OSS-RC system from where you exported the file. The current version of TEMS CellPlanner supports ICDM files of version R10. Files of other versions might be importable. A complete guideline has been requested about which edits are needed, but there is no such information in the current version of this manual. A typical patching often needed is to remove the BSC name preceding the cell name. Contact TEMS Support, see Support and FAQ on page 1-4, for any help with importing ICDM files.
- **The ICDM file must be complete when using it for HFS optimization.** AFP for Synth Hopping requires that values for all optimization and border cells are present.
- **Combine predicted and imported values when using the ICDM file for a fixed-frequency plan.** Interference table weights should be properly set when running AFP for Fixed Frequency or Baseband Hopping to minimize the risk for bad frequency assignments due to incomplete or faulty ICDM file.
  Set the weights as follows:

  ```
  Absolute interfered area = 1 or higher (non-zero)
  Relative interfered area = 0
  Absolute interfered traffic = 0
  Relative interfered traffic = 0
  Imported interfered traffic = 1 (non-zero)
  Normalize interference table = selected
  ```

  For more details, see Weight Settings on page 15-25 and Import Interference Tables on page 13-4.

AFP for Fixed Frequency or Baseband Hopping

See Automatic Frequency Planning (AFP) on page 18-7 for a quick overview on AFP.

Limitations

The limitations below are valid for AFP for Fixed Frequency or Baseband Hopping:

- See Limitations on AFP on page 18-7.
- Synthesizer hopping TRXs are ignored.
- You may only lock TRXs to an frequency of the same layer (BCCH or TCH), see Define Channel Group for GSM Cells on page 9-26. For example, if the BCCH layer includes carriers 1..10, it is not allowed to assign frequency 15 to a BCCH carrier and lock its TRX. A similar situation occurs for TRXs that have the planning policy "Keep". Since the AFP cannot change their frequency allocations, they are effectively locked. Therefore they may not have frequency allocations outside the frequency layer.

Run AFP for Fixed Frequency or Baseband Hopping

This type of AFP takes user-defined Separation Specifications and interference table weight options as input.

Prerequisites

- Consider the Limitations.
- Ensure all Prerequisites for AFP are fulfilled.
- All channel groups' TRXs must be configured for fixed frequency or baseband hopping when you Define Channel Group for GSM Cells.
- Select GSM Cell Forbidden Carriers for certain sets of cells.
- Generate GSM Neighbor Lists or Import Neighbor Lists.

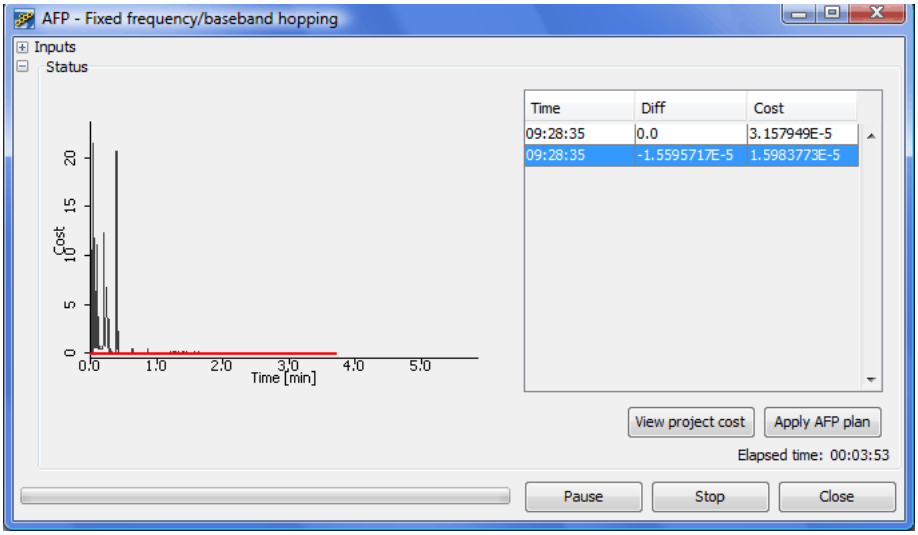
Procedure

Follow these steps to optimize a frequency plan for fixed or baseband hopping. taking interference into account:

1. Select **Analysis↗GSM↗AFP↗Fixed frequency/Baseband hopping**.
   The Window "AFP - Fixed frequency/Baseband hopping" is displayed.
2. Define Separation Specifications for the desired type of planning.
3. Set Interference table weight options.

   Note: *At least one of the absolute or relative weights must be larger than 0 if you want radio repeaters to be considered in the AFP calculation.*

4. Click **Start**. Previous results from other optimizations are cleared. The status panel displays the optimization status. It is updated each time the algorithm finds a solution better than the previous one.



The status graph illustrates the total cost over time. The table displays details about each vertex in the graph.

5. When you are satisfied with the results, click **Apply AFP plan** to and include the new frequency assignments in the project.

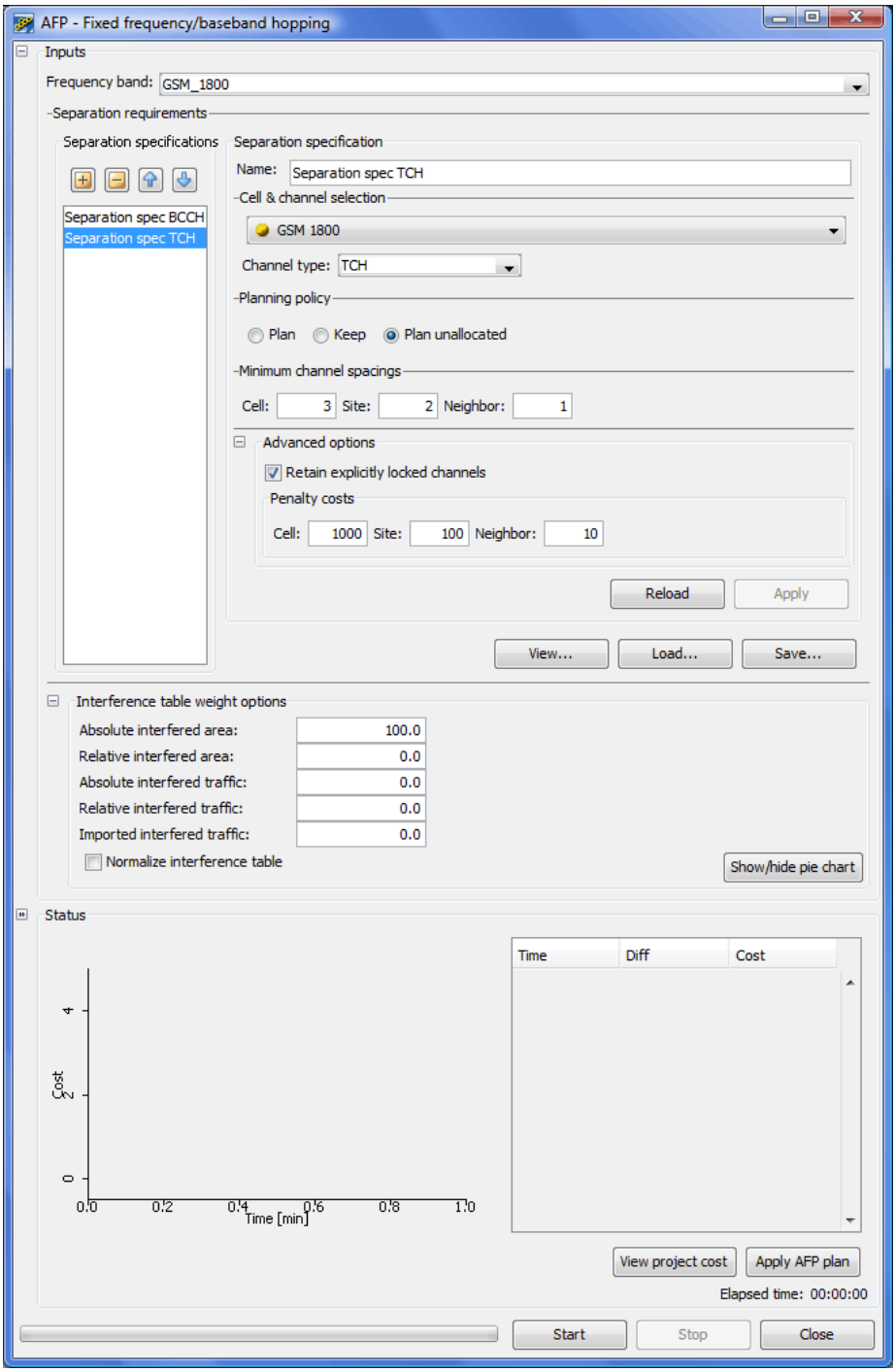
6. Now you can do any of the following:

   - Click **View project cost** to view remaining costs of the proposed plan.
   - Click the **F** icon on the vertical tool bar to display carriers. The plan shows the allocated frequencies of each cell in the map display as specified.
   - Select **Reports↗GSM↗AFP** to create a report showing the optimization results per TRX.

Tip: You can Recall GSM Configuration to undo an applied frequency plan.

Window "AFP - Fixed frequency/Baseband hopping"

The AFP window for planning of fixed or baseband hopping frequencies looks as in the following example where all parts of the window are expanded. You can expand or compress fields by clicking the + or - symbol respectively.



Fields on Window "AFP - Fixed frequency/Baseband hopping"

Frequency band	The frequency band to optimize in this AFP session.
Separation Specification Settings, see separate description	
Interference table weight options	The weights or factors combining the different interference tables into one interference table used for optimization, resulting in a cost for interfered TRX. The following weights are used when converting the interference table: • Absolute interfered area (> 0 to consider predicted interfered area) • Relative interfered area (> 0 to consider predicted interfered area) • Absolute interfered traffic (> 0 to consider predicted interference on traffic) • Relative interfered traffic (> 0 to consider predicted interference on traffic) • Imported interfered traffic (> 0 to consider imported measured interference) ***Note:*** *Radio repeaters are considered in AFP only if at least one of the first four (absolute or relative) parameters are > 0.* For hints about parameter settings, see Using Imported Interference Tables (ICDM) in AFP on page 18-8.
Normalize interference table	Option indicating that the values in the interference table shall be normalized, making it possible to compare interfered traffic and interfered area. See Using Imported Interference Tables (ICDM) in AFP on page 18-8.
Show/hide pie chart	A pie chart shows the interference weight distribution in a separate window, or is hidden.
Status	Displays the status of the frequency planner as a graph where the X-axis is the time and Y-axis is the cost. The graph is updated each time the frequency planner finds a better solution than the current best solution. • The red line indicates the best cost. • The black line indicates the current candidate The rate of status updates decreases after 2 minutes.
View cost	Displays a table of remaining costs.
Apply AFP plan	Updates the cell data in the project according to the proposed frequency plan.
Start	Starts optimization and clears the results from previous sessions. Once started, the button is changed into a **Pause** button.
Pause	Pauses optimization and turns the button into a **Resume** button.
Resume	Resumes optimization and turns the button into a **Pause** button.
Stop	Stops the optimization algorithm.

Define Separation Specification

Before you can Run AFP for Fixed Frequency or Baseband Hopping you must create one or more Separation Specifications.

Separation Specification

A *separation specification* is the TEMS CellPlanner implementation of a *separation requirement*. Both those concepts are explained in the *TEMS CellPlanner GSM Technical Reference Manual*.

Separation specifications must be complete. If a TRX of a cell is included in any separation specification, all TRXs of that cell must be included in the same or another separation specification.

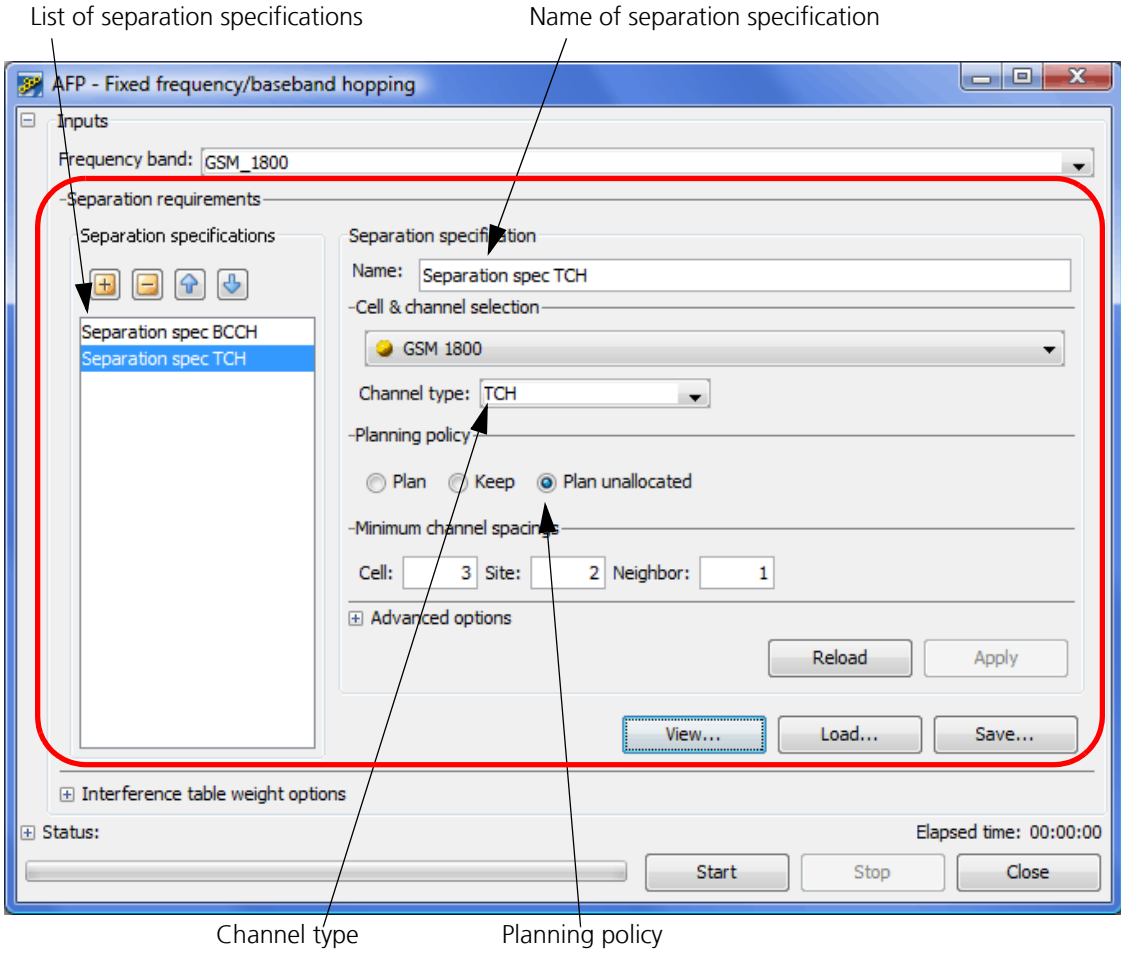
The separation specification in the example below is defined to assign unallocated frequencies to TCH TRXs of GSM 1800 cells.

For more examples, see Typical Separation Specifications for Various Scenarios.

Procedure

Do as follows to define a separation specification:

1. Initiate as in Run AFP for Fixed Frequency or Baseband Hopping to open the Window "AFP - Fixed frequency/Baseband hopping".



2. Click the icon to create a new separation specification.
3. Enter a name for the separation specification.
4. Optionally select a filter for the cells to include.
5. Select the **Channel type**(s) for which the separation specification is valid: BCCH & TCH, BCCH or TCH.
6. Select the **Planning policy**: Plan, Keep, or Plan unallocated
7. Set the **Minimum channel spacings** or accept the defaults.
8. Optionally change the **Advanced options** (not documented) to retain explicitly locked channels or change penalty values for calculation of interference cost.
9. Use the arrows to list the separation specifications in priority order.
10. Click **Apply** to include the separation specifications in the project.

Separation Specification Settings

Separation specifications	List of defined separation specifications for the frequency band. Each specification is related to a set of TRXs selected by a filter and channel type (BCCH and/or TCH). The separation specifications are listed in descending priority order. The specification at the top of the list has the highest priority during optimization. Move items in the list up and down to change the priority of the items.
	Adds or removes separation specifications
	Moves separation specifications up or down in the list to change priority in optimization.
Name	Name of the currently separation specification. Default name is "Separation spec (number)". Max 128 alphabetical or numerical characters. Do not use /,\,' or %.
Cell & channel selection	The **Minimum channel spacings** and interference cost criteria (in **Advanced options**) apply to the cells passing the filter, and to the TRXs of the selected **Channel type** (which is either BCCH, TCH, or BCCH & TCH). When a number of separation specifications overlap and the filters select the same cells, the specifications are prioritized. The separation specification with the highest priority is used by the optimization algorithm.
Planning policy	Specifies how to treat the selected TRXs when using this separation specification. • **Plan** - Carriers can be changed • **Keep** - Carriers cannot be changed, and unallocated TRXs will remain unallocated. • **Plan unallocated** - Only unallocated TRXs can be planned
Minimum channel spacings	Required channel separation between **Cell**s, **Site**s and **Neighbor**s.
Advanced options	• **Retain explicitly locked channels** - Explicit locks per TRX (in the channel group) are considered; otherwise the **Planning policy** determines the channel locking. • **Penalty costs** - The interference cost added each time a cell/site/neighbor separation rule is violated.
Apply	Preserves the values of the current separation specification in the project.
Reload	Reloads the values of the currently selected separation specification, as undo.
View	Displays the resulting planning policy, separations and costs per TRX, useful to see the effects of multiple separation specifications with different filters, planning policies, and so forth.
Load	Loads separation specifications from a file and removes previously displayed separation specifications.
Save	Saves all separation specifications to an XML file.

Typical Separation Specifications for Various Scenarios

The table below describes the settings of some typical AFP scenarios:

- Plan BCCH
- Plan TCH
- Re-plan part of network
- Plan BCCH, consider TCH and neighbors
- Plan TCH, consider BCCH and neighbor
- Plan BCCH and TCH, consider neighbors
- Plan new TCH TRXs, consider neighbors
- Plan for fixed BCCH & synth hop TCHs

Separation specification number 1 has the highest priority in the scenarios with more than one separation specification.

sep spec = Separation Specification

Scenario	Sep spec number	Filter	Channel type	Planning policy	Comment
Plan BCCH	1	cells to plan	BCCH	Plan	TCH channels are considered but not modified
Plan TCH	1	cells to plan	TCH	Plan	BCCH channels are considered but not modified.
Re-plan part of network	1	cells to plan	BCCH & TCH	Plan	For re-planning part of the network, for example, a single BSC in a multi-BSC network A separation specification is required to consider interference from adjacent cells.
Plan BCCH, consider TCH and neighbors	1	cells to plan	BCCH	Plan	Frequencies are assigned only to BCCH TRXs in cells passing the filter in sep spec 1. The TCH layer and neighbor cells passing the filter in sep spec 2 are considered but not modified.
	2	area including cells to plan and neighbors to consider	TCH	Keep	
Plan TCH, consider BCCH and neighbor	1	cells to plan	TCH	Plan	Frequencies are assigned only to TCH TRXs in cells passing the filter in sep spec 1. The BCCH layer and neighbor cells passing the filter in sep spec 2 are considered but not modified.
	2	area including cells to plan and neighbors to consider	BCCH & TCH	Keep	

Scenario	Sep spec number	Filter	Channel type	Planning policy	Comment
Plan BCCH and TCH, consider neighbors	1	cells to plan	BCCH & TCH	Plan	Plans BCCH and TCH layers in cells passing the filter in sep spec 1. Neighbor cells passing the filter in sep spec 2 are considered but not modified when planning for BCCH and TCH planned with sep spec 1.
	2	area including cells to plan and neighbors to consider	BCCH & TCH	Keep	
Plan new TCH TRXs, consider neighbors	1	cells to plan, the ones with the new TCH TRXs	TCH	Plan unallocated	Used when expanding a network by adding TCH TRXs to one or more cells. New frequencies are assigned to the new TRXs. Frequencies already allocated are not changed. The BCCH layer, and cells in the adjacent neighbor cells, are considered but not modified Already allocated BCCH and TCH frequencies are considered but not modified. Only TCH TRXs with unassigned carriers in cells passing the filter in sep spec 1 are assigned. BCCH channels passing the filter in sep spec 1, and all channels in cells passing the filter in sep spec 2, are considered but not modified.
	2	area including cells to plan and neighbors to consider	BCCH & TCH	Plan unallocated	
Plan for fixed BCCH & synth hop TCHs	See Mixed Planning for Fixed BCCH & Synth Hopping TCHs.				

Mixed Planning for Fixed BCCH & Synth Hopping TCHs

Fixed BCCH and synthesized hopping TCH frequencies can not be planned together in one AFP session. You must plan BCCH and TCH separately according to Alternative 1 or Alternative 2. Time slot 0 of the BCCH TRX will get a fixed frequency, other BCCH time slots and the TCH TRXs will be used for synth hopping (in Alternative 2 according to a hopping frequency set). View resulting frequency assignments in the channel group editor, see Define Channel Group for GSM Cells.

Alternative 1

In this case, TCH assignments are assigned by hand, and BCCH assignments are optimized.

Use pure manual planning to assign frequency groups to TCH:

1. In the System explorer: Create a frequency group set for **Synth hopping** (blocked or staggered), see Define Frequency Group Sets.
2. In the GSM RBS or Site explorer:
   - Select all cells, and channel groups, to plan (global edit).
   - Define Channel Group for GSM Cells with option **Synth hop**
   - Select the frequency group set defined above for the TCH TRXs. (The synth hop options in the channel group and its included frequency group set must match).

Use AFP to plan BCCH:

1. Define a separation specification to Plan BCCH, consider TCH and neighbors.
2. Run AFP for Fixed Frequency or Baseband Hopping. The BCCH frequency only is optimized. AFP takes the BCCH frequencies from the BCCH carriers selected for the Frequency band, and ignores the frequency group settings.

Alternative 2

In this case, both BCCH and TCH are optimized, but in different tools.

Use AFP to plan BCCH:

1. Define Channel Group for GSM Cells with option **Fixed**.
2. Define a separation specification to Plan BCCH.
3. Run AFP for Fixed Frequency or Baseband Hopping.

Use AFP (for synth hopping) to plan TCH:

1. Define Channel Group for GSM Cells with option **Synth hop**.
2. Run AFP for Synth Hopping.

AFP for Synth Hopping

This function is also called "HFS planning" or "HFS optimizer", where HFS is a set of *synthesizer hopping* frequencies.

Use this function to optimize frequency assignments for synthesizer hopping TCH TRXs. AFP assigns a hopping frequency set (HFS) to the TCH layer of each GSM site while optimizing the assignments.

Read the introduction in Frequency Planning in TEMS CellPlanner to see for which cases you should use this function, and when other functions are more suitable.

The theory and principles of HFS planning is described in the *TEMS CellPlanner GSM Technical Reference Manual*.

Run AFP for Synth Hopping

You can plan for single or multiple frequency bands, but you have to run AFP for one frequency band at a time.

Prerequisites

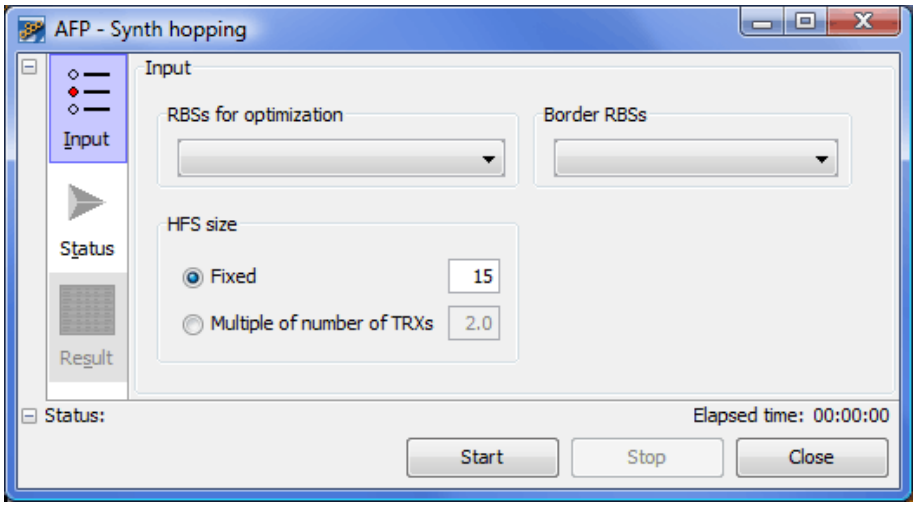
The following conditions must be met for all cells and RBSs to plan:

- See Prerequisites for AFP on page 18-7. All cells to plan and border cells must be included when generating the interference table.
- The RBS option **Synchronized** must be set, as involved RBSs must support synthesizer hopping. If you have forgotten to set this option, AFP will ask for your approval to set it automatically in all RBSs selected for planning.
- One channel group only per cell shall be enabled for synthesizer hopping (option **Synth hop**), see Define Channel Group for GSM Cells on page 9-26.
- All TCH TRXs must be configured for synthesizer hopping in the channel group.
- BCCH TRXs must be defined in a separate fixed-frequency channel group. No TCH TRXs may be included in this channel group.
- An ARFCN can only be used either for fixed-frequency/baseband hopping or synth hopping. The BCCH and TCH frequency layers may though overlap in the frequency band settings.
- The BCCH frequencies are planned by pure manual planning, Manually Optimized Frequency Planning or AFP for Fixed Frequency or Baseband Hopping.

Procedure

Do as follows to optimize the HFS plan with AFP:

1. Select **Analysis↗GSM↗AFP↗Synth hopping** from the menu to start the **HFS planner** wizard. The wizard's **Input** page is displayed.

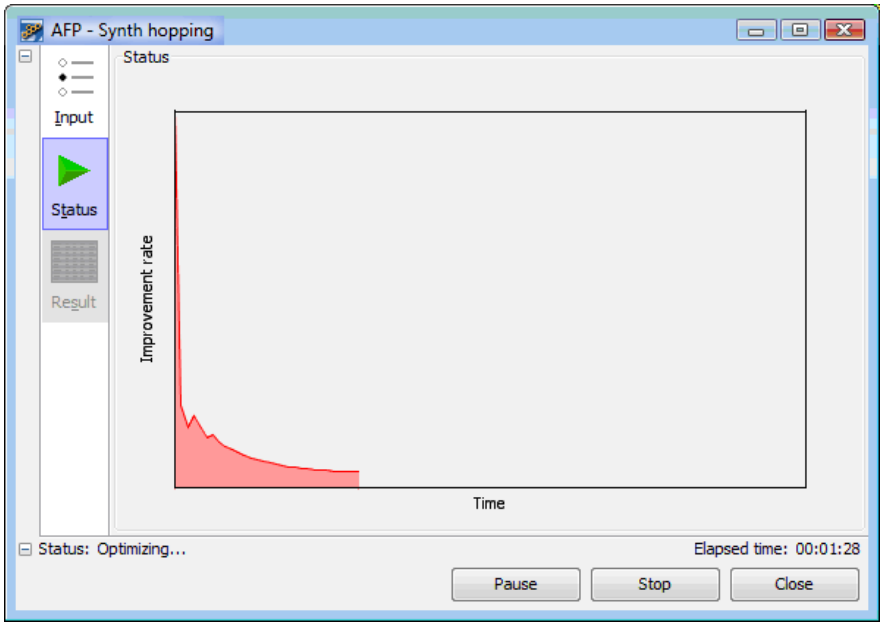


2. Optionally select filter for
   - **RBSs for optimization** - limits the number of cells to plan
   - **Border RBSs** - limits the number of border cells to consider in the optimization. These cells will not be optimized, but the optimizer will consider their interference on the cells to plan.
3. Define the **HFS size** - the number of hopping frequencies in the HFS - in either of the following ways:

Same for all sites:	Select option **Fixed** and enter a size.
Per site:	Select option **Multiple of number of TRXs** and enter a multiplier value. The HFS size per site will be the product of the multiplier and the maximum number of synth hopping TRXs in any cell of that site.

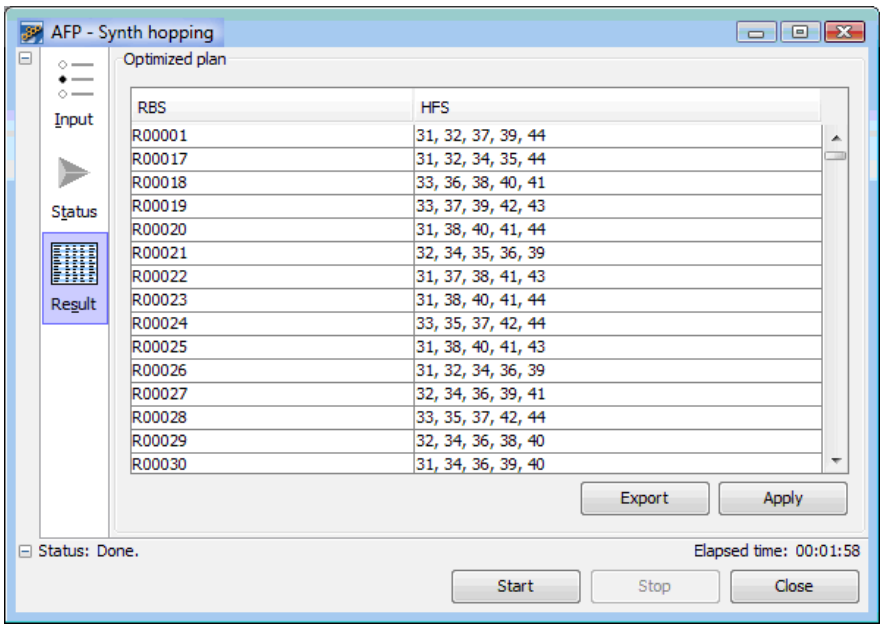
All cells in a site will get the same HFS size.

4. Click **Start**. Previous optimization results from other sessions are cleared, and the wizard displays the **Status** page where a chart shows the progress.



5. You may **Stop** the optimization manually, or wait until it is stopped automatically, which will occur when no progress has been achieved during a large number of trials.

6. Proceed to the **Results** page. The HFS plan is presented in a table with a proposed set of hopping frequencies for each RBS, as in the following example:



7. Click **Export** to export the HFS plan to an Excel file.
8. If you are satisfied with the results, click **Apply** to include the plan in the project.

After applying the results it is necessary to perform an HSN Optimization, followed by a MAIO Optimization.

BSIC Optimization

The theory and principles of BSIC optimization is described in the *TEMS CellPlanner GSM Technical Reference Manual*.

Optimize BSIC

Use the GSM RBS explorer **GSM cell - Configuration** window to enter NCC and BCC codes for each cell.

You can also define the **Permitted NCC** using the GSM RBS explorer.

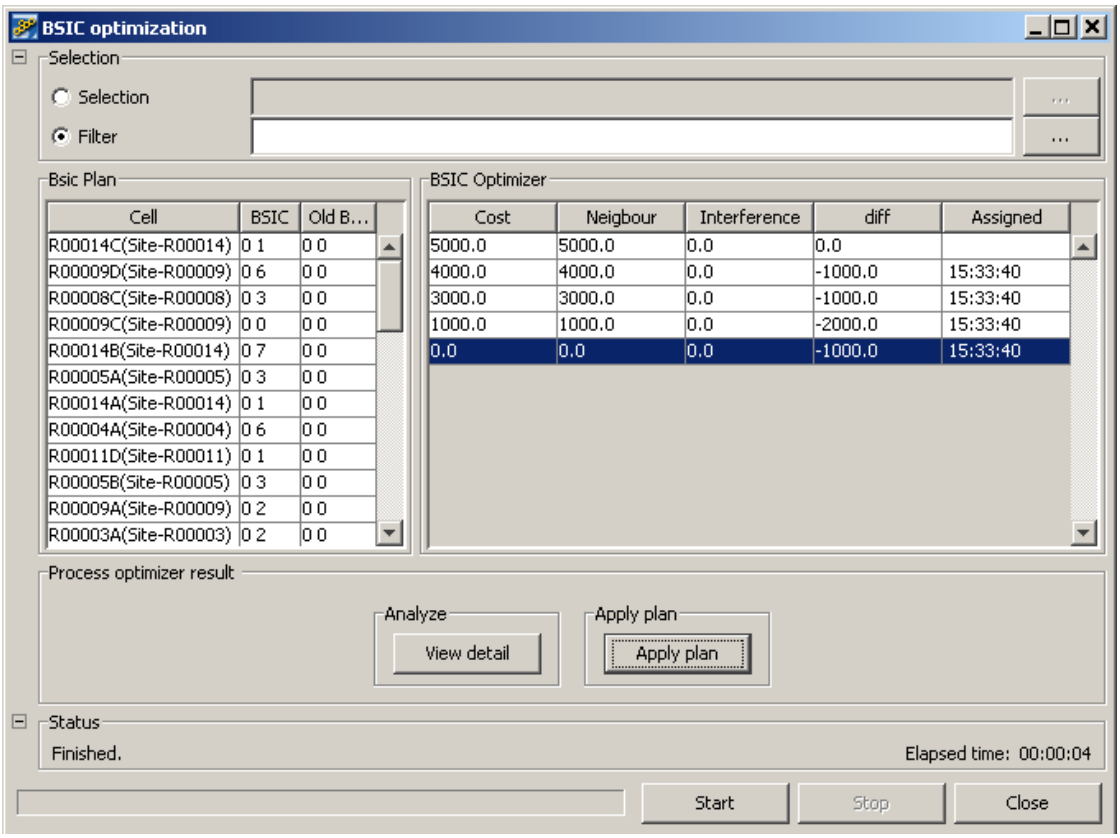
Prerequisites

An optimized frequency plan is available.

Procedure for Running BSIC Planning

Follow these steps to run BSIC planning:

1. Select **Analysis↗GSM↗Optimize BSIC**. The **BSIC optimization** window is displayed.



2. Click **Start** to begin BSIC optimization. The optimizer searches for the best solution to fit the network requirements.

   You can stop BSIC planning when you want. However, you can reduce the cost and penalty by continuing the optimizing process to find a better solution.

3. When you are satisfied with the BSIC plan, click **Import BSIC** to save the plan and import it into the GSM project plan.

Fields on Window "BSIC optimization"

Cell	The cell ID of cells being optimized
BSIC	Planned Base Station Identity Code (BSIC)
Old BSIC	Previously assigned Base Station Identity Code (BSIC)
BSIC Optimizer	Information for optimizing BSIC planning: • Cost - total cost of current plan • Neighbor - the total cost occurring from the neighbor list • Interference - • Diff - the difference between current plan and previous plan • Assigned - the time that the plan was modified
View detail	Analyzes the reason for cost
Import BSIC	Imports the saved BSIC plan into the current GSM planning project

Analyze the BSIC Plan

Use this procedure to analyze the results of BSIC optimization.

When the BSIC optimizer finds a solution that results in zero cost with no penalty, a message is displayed to inform you of the solution.

Only optimized cells are included in the cell list.

Prerequisites

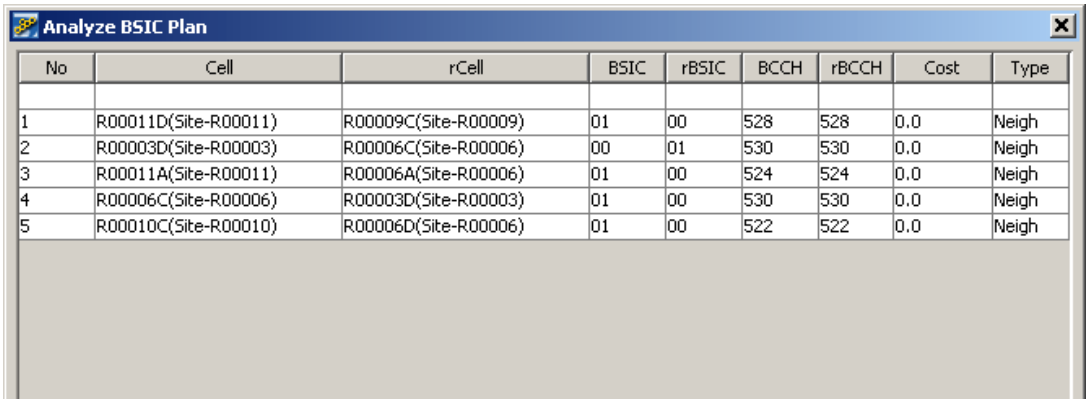
BCCH frequencies must be assigned to all cells.

Procedure for Analyzing BSIC Plan

Follow these steps to analyze a BSIC plan:

1. Select **Analysis↗GSM↗Optimize BSIC**. The **BSIC optimization** window is displayed.

2. Click **View detail** to display the **Analyze BSIC Plan** window.



No	Cell	rCell	BSIC	rBSIC	BCCH	rBCCH	Cost	Type
1	R00011D(Site-R00011)	R00009C(Site-R00009)	01	00	528	528	0.0	Neigh
2	R00003D(Site-R00003)	R00006C(Site-R00006)	00	01	530	530	0.0	Neigh
3	R00011A(Site-R00011)	R00006A(Site-R00006)	01	00	524	524	0.0	Neigh
4	R00006C(Site-R00006)	R00003D(Site-R00003)	01	00	530	530	0.0	Neigh
5	R00010C(Site-R00010)	R00006D(Site-R00006)	01	00	522	522	0.0	Neigh

Fields on Window "Analyze BSIC plan"

This window gives detailed information of cell relations that result in a cost:

No	The sequence number for the cell relation
Cell	The cell that the cost depends on
rCell	The related cell to a cell
BSIC	BSIC code for noted cell
rBSIC	BSIC code for related cell
BCCH	BCCH carrier for noted cell
rBCCH	BCCH carrier for related cell
Cost	The amount of cost
Type	The type of cost: • The cells are neighbor cells • The cells are in interference to each other

HSN Optimization

The theory and principles of HSN optimization is described in the *TEMS CellPlanner GSM Technical Reference Manual*.

Optimize HSN

Use this procedure to optimize HSN for GSM network plan.

Prerequisites

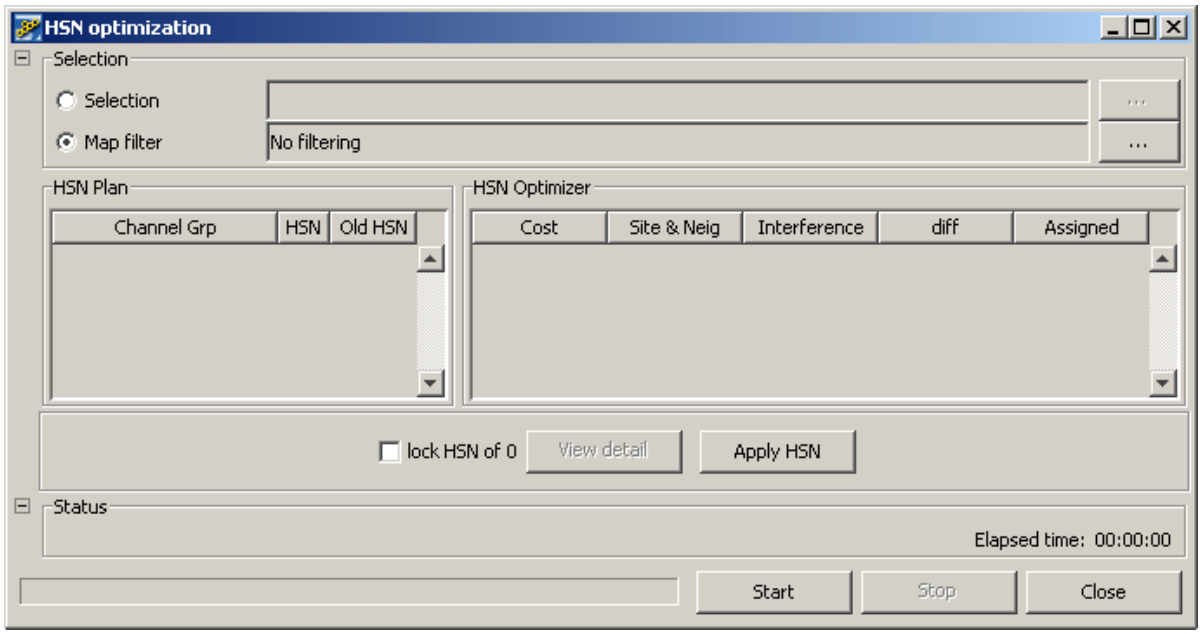
- Assign synthesizer hopping frequency group to each synthesizer hopping channel group
- Assign ARFCNs or fixed/baseband hopping frequency groups to each baseband hopping channel group.

Use the GSM RBS explorer **GSM channel group** window to enter the type of hopping. The hopping type for the TRXs can be synthesizer or baseband hopping. The default hopping sequence number is zero. Channel groups with hopping defined as "fixed" do not need hopping sequence numbers assigned to them.

Procedure

Follow these steps to optimize HSN for a GSM network plan:

1. Select **Analysis↗GSM↗Optimize HSN**. The **HSN optimization** window is displayed.



2. Click **Start** to begin HSN optimization. The optimizer searches for the best solution to fit the network requirements.

   You can stop HSN optimization when you want. However, you can reduce the cost and penalty by continuing the optimizing process to find better solution.

3. When you are satisfied with the HSN plan, click **Apply** to preserve the plan and apply it into the GSM project plan.

Fields on Window "HSN optimization"

Channel group	The channel group name of channel group being planned
HSN	Planned hopping sequence number
Old HSN	Previously assigned hopping sequence number
Cost	HSN Optimizer information for total cost of current plan
Site & Neighbor	HSN Optimizer information for the total cost occurring from the site and neighbor list
Interference	HSN Optimizer information for the total cost occurring from interfering cells
Diff	HSN Optimizer information for the difference between current plan and previous plan
Assigned	HSN Optimizer information for the time that the plan was modified using HSN Planning
Lock HSN of 0	Lock all HSNs with a value of 0.
Apply HSN	Apply the HSN optimization to the GSM network plan

Analyze HSN

When you click on the button **View detail,** a new window is opened, where you can see the site, neighbor and interference cost of every assigned HSN caused by another assignment.

MAIO Optimization

The theory and principles of MAIO optimization is described in the *TEMS CellPlanner GSM Technical Reference Manual*.

Optimize MAIO

Use this procedure to run MAIO planning.

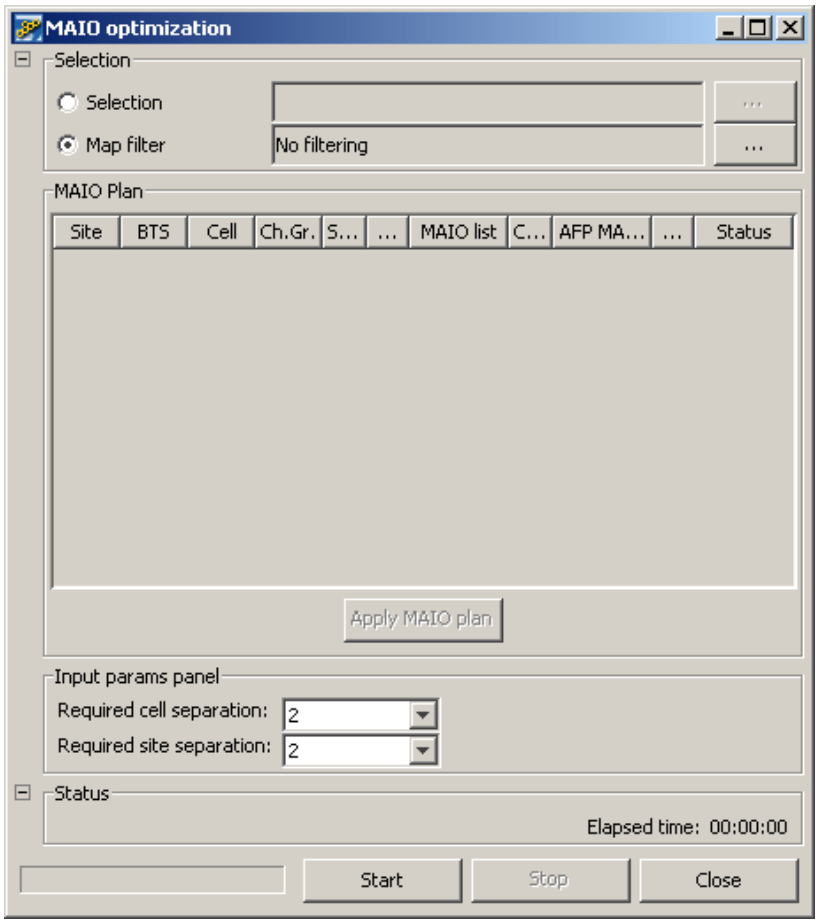
Prerequisites

- Synthesizer hopping frequency groups have been assigned to the synthesizer hopping channel groups.
- An HSN plan has been applied.

Procedure

Follow these steps to optimize MAIO planning:

1. Select **Analysis↗GSM↗Optimize MAIO**. The MAIO optimization window is displayed.



All or a subset of GSM sites are displayed in the **MAIO plan** table, depending on filters applied. The cells displayed are included in the MAIO optimization.

2. Change the cell and site separation requirements if desired, and click **Start**.

   Synchronized channel groups with identical HSN belonging to the same BTS are optimized together. An optimized MAIO plan is calculated where the total interference cost of the channel groups is as low as possible.

   - Unsynchronized channel groups are optimized on a per channel group basis.

3. When you approve the proposed MAIO list, click **Apply MAIO plan**. Existing MAIO lists are replaced by the optimized lists in the network plan.

Fields on Window “MAIO optimization”

MAIO plan	Site, BTS, Cell, Ch.Gr. - Identifies the channel group for which an optimized MAIO list is calculated Sync - Indicates the BTS/cell/channel group is synchronized HSN - The hop sequence number of the channel group. MAIO List - The MAIO list manually entered in the Channel group information for the GSM cell. Cost - Indicates the interference cost for the initial MAIO list, if exist, and if possible to calculate. AFP MAIO List - A better MAIO list, if found by MAIO planning AFP Cost - The interference cost of the AFP MAIO list. Status - Displays messages about problems with input data, or cell separation requirements not met.
Apply MAIO plan	Replaces the existing MAIO list in the channel groups with ones calculated by MAIO planner.
Required cell separation	Changes the cell separation requirement. Values for cell separation: 1 - 3.
Required site separation	Changes the site separation requirement. Values for site separation: 1 - 2

19
Maps and GeoData

A network plan is based on radio network data and map related information, GeoData.

As a radio network designer you need a basic knowledge about GeoData and how to use it in TEMS CellPlanner.

As a map administrator you need a deeper knowledge about GeoData, how to convert maps and perform other advanced GeoData related operations in TEMS CellPlanner.

Read more about GeoData in the *TEMS CellPlanner GeoData User's Guide*.

20
Puncturing

You can improve the accuracy of the pathloss predictions by using measured values of received power in selected parts of the GSM network plan.

This feature describes how to read measurement data from TEMS Investigation, TEMS Automatic and TEMS Pocket, and how to save the imported measurements as pathloss data files for later use in pathloss calculations.

The recommended feature for integration of measurement data for pathloss calculations is Automatic Measurement Integration (AMI), described in the *TEMS CellPlanner Common Features User's Guide*.

See the *TEMS CellPlanner Common Features User's Guide* for information on how to puncture predicted results with measurement data.

21
Script Console

The script utility enables a TEMS CellPlanner user to perform complex customized operations from the **Utilities** menu.

The script support is based on Jython, a variant of Python supporting Java. Before using the script console, you must learn the basics of Python.

Scripts can access and modify a network configuration loaded into the client. Most dialogs in the tool can also be controlled by scripts. Scripts can be executed automatically at startup of a client.

Examples of script usage:

- Conditional modification of attributes
- Advanced search
- Specialized reports
- Specialized imports
- Sophisticated object renaming operations

Read more in **Help↗Manuals↗Script Support.**

22
GSM Glossary

The terms used for planning a GSM network are described in the *Glossary* of the *TEMS CellPlanner Common Features User's Guide*.

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